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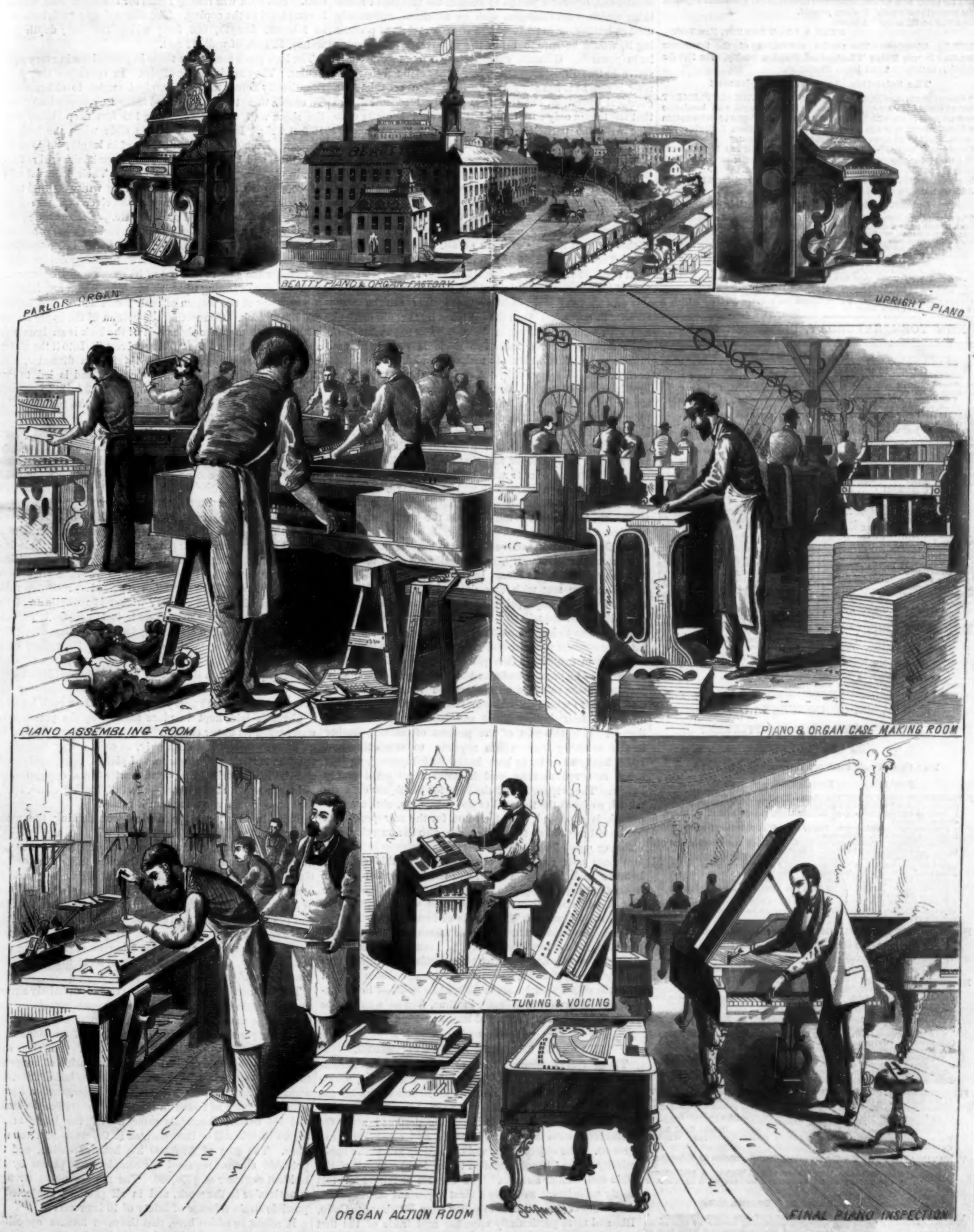

THE BEATTY PIANO AND ORGAN FACTORY.—[See page 396.]

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 20, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 207,

For the Week ending December 20, 1879.

Price 10 cents. For sale by all newsdealers.

SCIENCE AS APPLIED TO TANNING.

Considering the immensity of the trade, modern science has done but little for the tanning industry. Except in the perfecting of a comparatively few simple mechanical devices for the saving of labor, the work of tanning heavy leather is now very nearly the same as it was a hundred years ago. The time required for tanning has been shortened by the use of stronger bark solutions, and more frequent handling of the hide or skin in such liquors, but the principle is the same; a greater variety of tanning agents is employed, but the astringent principle, similar to that found in oak bark, and which exists in greater or less proportion in almost every plant, must be sufficient to combine with the gelatine of the hide, which alone makes tanned or tawed leather.

Yet there has been no lack of endeavor in this field, for a substantial, or even a partial success, in the making of something which would compete with an article so universally used as leather, or in perfecting a cheaper mode of producing it, would be sure to bring the discoverer or inventor large rewards. German chemists have been especially active in this direction. One of them has claimed that tanning is not, as it has always heretofore been considered, a chemical operation, but that it is simply mechanical, and that the tannin only surrounds, but does not actually combine with, the particles of gelatine. This theory has not met with general acceptance, but it is, nevertheless, certain that leather tanned with some descriptions of tanning material, such as valonia, gambier, and divi-divi, can be again so far brought back to the raw hide condition as to be suitable for use in the making of glue. The most noteworthy result of the recent efforts of German chemists has been, however, in the perfection of a method of making leather without the use of bark at all, by what is called a mineral tanning, with a solution principally of iron, making what is called an iron tanned leather. Some very fair samples of both upper and sole leather have been produced by this process, and it is claimed that leather can be made thereby in much less time than it takes by the old method, and with a material saving in the cost. It is to be remarked, however, that the sole leather so made is very hard and brittle, so that it is difficult to make up and finish in a boot or shoe, and is liable to chip out and wear away rapidly except in wet weather. It seems, however, to have sufficient toughness, when wet, to resist a good amount of wear, and its water-resisting qualities are about equal to those of many kinds of bark tanned leather. That it will, as at present made, come into competition with our leather, does not appear at all likely, but the fact that hides and skins are now chemically treated so as to make an article nearly resembling bark tanned leather, and which will make serviceable boots and shoes, marks a step forward in the progress of an industry which, though one of the oldest in the world, has probably shown less change than any other.

The German process above alluded to has been covered by two patents in this country, but no leather of such manufacture has yet been made here. In fact the process can hardly be said to have met with any decided favor in Germany, where, from the high price of tanning material, and the generally inferior quality of the sole leather manufactured, it would seem to have most chance of being adopted. The patents cover the process, and a new chemical compound, as a mineral reagent, in the place of a vegetable tanning material. The process includes the making of a peculiarly prepared basic sulphate of iron, which forms the tanning material, into which the hides or skins are placed for two, or at most four days, without any handling or changing liquors. It is this part of the process of making leather in the ordinary way which requires so much time and labor, heavy hides being kept in the bark liquors from four to six or seven months, and in some cases considerably longer. The preparation of the hide for the liquor or compound, so far as the removal of the hair, flesh, etc., are concerned, is supposed to be the same for the new process as by the old method of tanning, as are also the currying and finishing operations.

We can now make very cheap leather in this country, because bark is so abundant, and the iron-tanned leather has not yet been brought to such a standard of excellence that it can compete with the product which our native forests supply us with the means of furnishing; but it requires no long look into the future to see that these conditions may, at no very distant day, be reversed. Our woods are being rapidly destroyed, so that available bark for tanning is found, year by year, only at greater distances, and this will afford additional incentives to a spirit of investigation and research which may, in time, find us a substitute for bark in the manufacture of leather.

THE GREAT CHANOINE DAM AT PITTSBURG.

The general government is at present engaged in constructing near Pittsburg an experimental lock and dam, which when completed will be among the largest works of the kind in the world. The dam will be the largest "movable" one yet built in this country, being designed after the Chanoine system in use in the Seine and other European streams. The object of the work is mainly to test the applicability of the Chanoine system to the improvement of the Ohio and similar streams. The success or failure of this costly experiment will have a most important bearing upon the future of the entire Ohio valley from Pittsburg to Cairo, Ill., and more particularly upon the coal trade of the first named city.

The site selected for the work is located five miles below the junction of the Allegheny and Monongahela Rivers, and near the northwestern city limits of Pittsburg. The Ohio at this point has a width between banks of 1,300 feet, and the stream itself varies in width from that distance down to 700 feet, according to the stage of water. Operations were begun August 19, 1878, and with the exception of two months' cessation last winter have continued ever since. The force employed has varied from 50 to 450 men. Col. W. E. Merrill, whose headquarters are at Cincinnati, is chief engineer, but the work is under the immediate supervision of Lieut. F. A. Mahan, resident engineer. No great engineering difficulties have been met with, and the season of extraordinary low water during the past summer and fall has greatly facilitated the laying of the foundations for the river wall of the lock. The latter is located at the northern end of the proposed dam. Bed-rock was readily found for the shore wall, which is completed to the coping. The dimensions of this lock are as follows: Length, 600 feet; width, 110 feet; depth (of water), 12 feet, of wall, 17 feet.

The lock gates are unlike those in general use in every particular. They are immense affairs. In operation they will run directly across the lock at right angles to either wall. To enable them to be so operated immense recesses lead from the shore wall, each recess being 120 feet deep (long) and 15 feet wide. Into these the gates slide when the lock is opened. Each gate measures 118 feet in length, 10½ feet in thickness, and 14 feet in height; and these affairs will resemble, in place, a truss bridge on edge. Their material will be wood or iron. If of the former they will weigh 80 tons each. An offset in the masonry of the river wall serves as bearings for the outer end of each gate. The operating device for these ponderous gates will be turbine wheels, actuating upright and lateral shafting, so arranged in connection with suitable gearing, endless screw, reversing device, etc., as to draw the gate in and out of its recess upon seven pairs of iron rollers running upon rails. The latter are laid on the masonry at the bottom of each recess and across either end of the lock. Connecting the bottom of the upper recess with the bottom of the shore side of the lock is an immense arched tunnel termed the "filling culvert." Into it the water pours from seven circular inlets, 4⅛ feet in diameter, and fitted with balanced wing valves or gates, and is led to the lock, which is filled through ten openings, 3 by 3½ feet, and 17 feet below the coping. By this means the lock can be filled or emptied in four minutes.

So much for the lock. The dam will be 1,200 feet long, subdivided into three "passes" of 400 feet each. The channel pass, or that nearest the lock, will be that across which the movable or Chanoine dam will be placed. A solid sill of masonry and timber must first be laid across the bed of the river. To the timber is hinged a series of wickets of stout oaken planks, each 13 feet in length by 3 feet 8 inches in width. A space of 4 inches separates each wicket, and a hinged prop or arm forms part of the wicket, the whole being so arranged that when the wicket is drawn to a position almost perpendicular, its prop, as to its free end, slides into a metal "step." This operation repeated constitutes raising the dam, inasmuch as every wicket is a duplicate of its neighbor. Lowering the wickets is instantaneously accomplished by means of a "tripping bar" extending along the series and resting upon the dam sill. By its agency each prop is disengaged from its "step," the water presses wicket and prop prone upon the bottom, and the channel is virtually clear of obstructions. The spaces mentioned as existing between each wicket are thus provided for: Over each interval a plank is laid, kept in place mainly by the pressure of water upon its upper surface. These planks are connected by links at their upper ends only, in such a way that when the dam is "tripped," the chain of planks, being connected, and the whole series being permanently fast at one end only, swings away with the current—a sort of floating chain, ready for service again when the dam is raised.

Such, in brief, are the devices constituting the main features of the Chanoine dam, which will rise and fall—according to the stage of water—across the channel of the Ohio at the point in question. When the river falls to less than a six foot stage the wickets will be raised by gangs of men in boats working simultaneously toward the center of the pass. When up the crest of the dam will be 12 feet above the sill, and the "back water" will extend into the mouths of both the Allegheny and Monongahela rivers. This, of course, means navigable water about the wharves of Pittsburg and her sister city, Allegheny. At present local towage is only possible during a portion of the year.

The engineers in charge have as yet not definitely agreed upon the style of wicket for use in the two remaining sections of the dam, but that they will be movable is certain. Up to the present time 6,000 cubic yards of cut stone have been laid in this work, all in the shore wall. The river wall will require 4,000 yards, laid upon a foundation of concrete, the latter starting at a level 15 feet below the bed of the river, upon hard firm gravel. The concrete is composed of 5 parts sand and gravel as found in the river, 3 parts broken stone, and 1½ barrels Rosendale cement. Of the latter nearly 80,000 barrels will be incorporated in the walls and foundations. The sum of $200,000 has been expended, and the probable amount required for completion is placed by the resident engineer at $750,000. The most massive strength is noticeable in the work, and in all portions subjected to possible strain a factor of safety of 10 is preserved.

It might be added here, that the most intense opposition to the building of this dam was evinced by the river coal trade of Pittsburg, whose members held that the success of

the work and the resultant and possible multiplication of Chanoine dams along the Ohio would inevitably destroy the coal trade of Pittsburg, as far as river shipments were concerned. Within the past few months, however, this opposition has given way in marked degree. The change of feeling is mainly attributable to causes novel and unlooked for. Owing to almost unprecedented and long-continued drought laden coal craft, containing 20,000,000 bushels (760,000 tons) had up to the middle of November, 1879, accumulated at Pittsburg, when the article was bringing famine prices in Cincinnati. At the date mentioned timely rains permitted a third of the accumulation to pass down the Ohio. But the argument for an artificially improved river was potent in the extreme, and to-day even the river coal trade of Pittsburg advocates the "Davis Island Dam."

THE ANGAMAR STEAM PASSENGER CAR.

For ninety consecutive days during the past season the Angamar steam passenger car "Lillie" has been running upon the Third Avenue surface railway, part of the time hauling an extra car. The experiment continued long enough to make it clear that a proper steam passenger car can be used safely and successfully in summer time, even in crowded thoroughfares. There is probably no street railroad in the world on which cars are run at briefer intervals, or where the necessary stoppings and startings are more frequent than on our Third Avenue road; nor one where the necessity is greater for quickness of action and entire regularity in running. If the Angamar motor can meet the severe requirements of winter traffic with corresponding success, the car horse may look for a change of occupation, and the community be relieved of the growing nuisance of his presence in our cities.

Superior economy is claimed for this motor, as compared with other steam locomotives, on the following grounds: 1. The water is heated in a stationary boiler, thus making a great saving of fuel in comparison with locomotive boilers. 2. There is no water level to watch, no injectors to take care of, and no fire to attend to during a trip. Hence the motor does not require a high-priced skilled engineer to run it, any average man of the class of car drivers being able to do the work. 3. All the working parts are protected from dust and dirt by close-fitting boxes, thus reducing the wear to the minimum. There is a further advantage in the circumstance that the machinery is so arranged upon the truck that the ordinary cars in use can be easily converted into self-propelling cars.

The Angamar motor runs without any noise of escaping steam, is easily handled, and does not frighten horses. The boiler is supplied with hot water under pressure at the central supply station, where the furnace is filled with red-hot coal in quantity sufficient to keep up the initial pressure in the boiler during the trip. The amount of coal required for this purpose and for heating the water in the stationary furnace was, during the ninety days' test, one third of a ton of egg coal a day. The volume of water in the boiler is so large and the fire in the furnace so small that all risk of explosion is avoided.

A NEW PLAN FOR HEATING HORSE CARS.

The Third Avenue Company, of this city, have introduced a novel plan of heating their cars. Metal pipes about 4 inches in diameter are laid under the seats and filled with salt water. At one end of the car the pipes unite in a sort of box surrounding a chamber called the oven, about 12 inches long, 5 inches wide, and 4 inches high. The door to this oven is through the end of the car, just above the platform, and consists of a box of non-conducting material nearly filling the oven. The water is heated at the stables by means of a block of highly heated iron thrust into the oven, nearly filling it. When the car leaves the stable the iron is removed and the oven closed, the heated water in the pipes sufficing to keep the car warm throughout the trip. Salt water is used to lessen the risk of bursting the pipes by frost, should the car be kept overlong on the road. So far the plan contains nothing objectionable. To economize heat, however, the company have had the car windows fitted with extra casings, permanently closing them, trusting to the opening of the doors, in the admission and discharge of passengers, for the supply for fresh air. Unless the ventilators in the roof are kept well open this plan is liable to add a new terror to horse car traveling. The atmosphere of crowded horse cars is bad enough at best; if its renewal is to be left to chance they will be little better than pest holes.

A HOT WATER RIVER.

The projector of the Sutro Tunnel is of the opinion that the hot water which is so troublesome in the Comstock mines comes from a depth of ten or fifteen thousand feet, where the rocks are at a high temperature; also that there must be some connection between the water of the Comstock lode and that of the boiling springs at Steamboat, six or seven miles distant.

One of the great advantages of the tunnel is the means it affords for draining the mines. The tunnel discharges about twelve thousand tons of water every twenty-four hours. To lift this water to the surface would cost not less than $3,000 a day. Some of the water has a temperature of 165° where all the water mingles; four miles from the mouth of the tunnel the temperature ranges from 130° to 135°. If left to flow through the open tunnel this water would so fill the air with steam as to make the tunnel impassable. In flowing the four miles through a tight flume made of 3 in. yellow pine, the water loses but 7° of heat. At the mouth of the tunnel the water is conducted sixty feet down a shaft to a water wheel in the machine shop, whence it is carried off by a tunnel eleven hundred feet in length, which serves as a tail race. From this tunnel the water flows a mile and a half to the Carson River.

This large flow of warm water is now used for many purposes, the first to utilize it having been boys who made small ponds to swim in—pioneers, it may be, in establishing a system of warm baths, which may ultimately become a great sanitary resort. The water can also be turned to account in heating hot houses and for irrigation. The tunnel company have a farm of over a thousand acres which, when properly watered, is very fertile. In course of time there will probably be many acres of fruit and vegetables under glass at this point, all warmed and watered by the tunnel water.

NEW YORK ACADEMY OF SCIENCES.

At a meeting of the Academy, held December 1, President Newberry exhibited some very fine quartz crystals from Herkimer county, N. Y., and also two slabs of perfectly preserved fossil fishes from the extensive Eocene formation of Wyoming Territory. This formation, which is about 7,000 feet thick, shows evidences of three successive deposits, and is exceedingly rich, not only in the remains of fishes, but of birds and mammals. The abundance of fish remains is accounted for by the supposition that the fish were overtaken by some sudden disaster, by which great numbers perished at the same time; that they floated for a while on top of the great lakes they inhabited, and eventually sank to the bottom. The occasional great mortality of fish in the Gulf of Mexico, where the decaying remains sometimes cover a very large area, to the great annoyance of travelers, furnishes an analogy to these prehistoric catastrophes, and suggests the explanation that they were caused by the evolution of poisonous gases from the bottom during volcanic eruptions. In Oregon, where fish remains similar to those of Wyoming are found, there is also evidence of volcanic eruption.

Captain Blake stated that during the great eruption of Mauna Loa, in 1841, the surface of the water was covered with dead fish for miles. Dr. Martin suggested that numbers of small fish frequently perish near the shore by being cut off in lagoons left by the receding tide. As the water evaporates, the fish are brought more and more closely together, until, finally, there is not sufficient water left to keep them alive. The paper announced for the evening on

THE PROBOSCIS OF THE HOUSE FLY,

by Dr. George Macloskie, of Princeton College, was one of unusual interest to the comparative anatomist, as it embodied the results of orginal work in investigating and interpreting the organs of the house fly (*Musca domestica*).

The general structure of the proboscis is very similar in the house fly and in the other kinds of flies with which we are familiar. Indeed the analogies it is proposed to point out will apply with greater or less exactness to the whole order of diptera. The stomaxys, or piercing fly, which is sometimes very common in our houses, may be distinguished from the domestica by its brown, ringed proboscis, suggesting an elephant's trunk. It is only partially retractile, but able to pierce our skin, an offense which the domestica is incapable of committing. Another misdeed of the stomaxys, for which the house fly has been unjustly blamed, was found during these investigations. The piercing fly was often observed to have her head and proboscis crowded with eggs. That these were not her own eggs was evident from their different shape, and then they were in the wrong end of the insect. Further observation showed that these eggs developed into anguillula worms, resembling paste eels. Here then we have one of the ways in which the fly defiles articles of food, etc.

Dr. Macloskie then referred to large diagrams to show the structural resemblances of the cray fish, the cockroach, and the fly, calling especial attention to the number of segments in the body, the maxillæ, the mandibles, and the calcareous tendons attached to the latter. In all the diptera the mouth parts are modified into organs of suction with or without piercing apparatus. The house fly alone has a retractile proboscis that folds up like a letter Z, and is drawn into the head when not used. It is traversed by channels connecting with the trachea, and is protruded, not by muscular action, but by the inflation of its chitinous membranes. The anterior end of the proboscis consists of a knob, and contains the lips and a series of forked half rings, by means of which the fly rasps the surface from which it gathers its food. The teeth of the house fly have three cusps, and form a single row of five or six on each side, while the blow fly and others have as many as thirty teeth, or three rows on each side, each tooth having only two cusps.

No difficulty was experienced in explaining the analogy of these and the other numerous parts of the fly's mouth apparatus to those of the crustacea, until the largest of them was reached, the organ to which the tendons, corresponding to the mandible tendons of the lobster, are attached. An opportune katydid, that flew into the room of the investigator at the critical moment, solved the difficulty, as a dissection of its head revealed the presence of an interior skull or endo-skeleton, a part not possessed by the diptera. The explanation laid before the Academy was that the organ in question represented a rudimentary internal skull in the head of the house fly. C. F. K.

Sorghum in the West.

The first annual convention of the Mississippi Valley Cane Growers' Association met in St. Louis, December 3. The secretary reported that since the organization of the society last spring he had been in correspondence with persons in 35 States and Territories in regard to the culture of sorghum, and that a very great interest is manifested in regard to the matter everywhere, especially in the North. Colorado is particularly well adapted to cane growing, and Texas might raise two, perhaps three, crops a year. In the discussion of seeds and their culture several members gave their experience.

Mr. C. H. Miller, of Minnesota, thought the Minnesota-grown seed preferable for that climate, the cane from it being earlier than from seed raised in more southern regions. Southern-grown seed produced larger cane and more sirup, but the cane did not, as a rule, mature early enough for the extreme Northern climate. The weight of testimony seemed to be in favor of the early amber variety, but Honduras early, and orange Siberian, and one or two other varieties, were well spoken of. There is much enthusiasm among cane growers, and some of them believe that in five years this country will not only have stopped importing sugar, but will export large quantities.

Advance in Leather Belting.

A meeting of manufacturers of leather belting, at which were representatives of fully 75 per cent of the capital invested in this business, was held at the Astor House, New York, on the 4th inst. It was determined to advance prices ten per cent over those now ruling, such increase to take effect immediately. This is the third advance in prices which has been made since the 24th of July, the aggregate increase amounting to 40 per cent. By the new scale of prices, the charge for pure oak belting will be 33 cents per foot for 3 inch, 69 cents per foot for 6 inch, $1.05 per foot for 9 inch; $1.41 per foot for 12 inch, and $3.22 per foot for 24 inch, with 100 per cent more right through for double belting; but with discounts ranging from 30 to 37½ per cent with the different firms. The belt manufacturers, although they do not form a close combination, have for a long time past made a common scale of prices, which it is generally understood they will all adhere to, except in such particular exigencies as may seem to call for variations in order that a house may protect its own trade or its customers as against outside competition.

One More Number.

The next issue will close another volume of this paper, and with it several thousand subscriptions will expire.

It being an inflexible rule of the publishers to stop sending the paper when the time is up for which subscriptions are prepaid, present subscribers will oblige us by remitting for a renewal without delay, and if they can induce one or more persons to join them in subscribing for the paper, they will largely increase our obligation.

By heeding the above request to renew immediately, it will save the removal of thousands of names from our subscription books, and insure a continuance of the paper without interruption.

Kitchen's Horse Detacher.

In the illustrated description given in our last issue of the novel horse detacher recently patented by Mr. W. R. Kitchen, the address of the inventor was omitted. Persons desiring information concerning this much needed invention should address, Mr. Kitchen, at Willard, Carter Co., Ky.

A Ten Years' Average of American Crops.

The annual averages of the below-mentioned crops include the period from 1868 to close of 1877. The estimates are from the statistics of the Treasury Department:

	Annual average product'n bushels.	Annual average total value.	Average value per bu. cents.	Average yield per acre. bu.	Av. value of yield per acre.
Oats	291,086,670	$116,810,592	40·1	28	$11·22
Rye	18,016,080	15,091,207	83·7	13·7	11·51
Corn	1,068,959,550	525,211,602	49·1	26·4	12·97
Wheat	273,583,174	301,481,541	110·2	12·12	13·40
Buckwheat	10,338,070	9,304,801	84·1	17·2	14·51
Barley	30,606,609	25,365,450	82·9	23·2	18·41
Potatoes	126,259,470	75,011,668	59·4	90·9	54·04
	Tons.		per ton.	tons.	
Hay	26,272,810	321,961,659	$12.60	1·21	15·25

Temperature of the Sun.

Newton, Waterston, Ericsson, and Senchi have asserted that the sun's temperature cannot be less than from 1,000,000° to 2,000,000° (1,800,000° to 3,600,000° Fah.); Pouillet, Vicaire, Violle, and many others maintain that the temperature cannot exceed from 1,500° to 2,500° (2,700° to 4,500° Fah.). The French Academy, in 1876, offered a "Bordin Prize" for the solution of the question, which resulted in a reward to Violle, certificates of "honorable mention" to Vicaire and Crova, and a withdrawal of the prize, in consequence of the difficulty and uncertainty involved in the question. Senchi obtained more than 2,000,000° by Newton's formula, while Violle obtained only 1,500° by the formula of Dulong and Petit from the same set of observations. F. Rosetti, in a memoir crowned by the Royal Academia dei Lincei, discusses experiments and methods of his own, from which he concludes that the temperature cannot be much less than 10,000° (18,000° Fah.), or much more than 20,000° (36,000° Fah.).—*Ann. de Chim. et de Phys.*

The Petroleum Industry.

The production of crude petroleum in the Pennsylvania oil fields has been a very progressive business from a very insignificant beginning. In 1859, when Colonel Drake sank the first oil well and obtained a few barrels of oil per day, he probably had no idea, says *Stowell's Petroleum Reporter*, of the growth and magnitude of the business as it is to be seen to-day with its 12,000 producing wells; with its daily production of 60,000 barrels of crude oil; with its 500 iron tanks with storage capacity for 10,000,000 barrels; with 8,000,000 barrels of stock in the tanks; with its refining capacity of 60,000 barrels per day; with its 3,000 miles of pipe lines for carrying the product to the iron tanks and refineries; with its 3,000 tank cars with capacity to transport 250,000 barrels of oil; with its 2,000 miles of iron tubing and casing used in and around the wells; with its 12,000 engines and 10,000 boilers used at the wells; with its 200 miles of rope cable, and its 500 tons of iron and steel used in drilling the wells; with its export trade with all the countries of the world of 40,000 barrels per day, and its home consumption of 10,000 barrels per day.

The outlook for better prices for the future are somewhat encouraging, as the great prolific Northern oil field apparently has its limits well defined, and its producing area circumscribed. The haste now manifested in drilling the best territory is so apparent that we may look for a speedy exhaustion of the field.

In Pennsylvania the number of producing wells at the close of October was 11,860, and the oil production for the same month was 1,863,378 barrels of 41 gallons each.

American Turbines in Peru.

An eighty-stamp mill has been recently erected for reducing the silver ores of the Cerro de Pasco Mines, Peru. It is driven by water power coming from a lake near the mines, the supply being sufficient to work more than 1,000 stamps and the accessory machinery. The power is utilized by means of six double turbines made by Messrs. Leffel & Co., of Springfield, Ohio. Four of these turbines are 30 inches in diameter, and develop each 200 horse power; the other two are 23 inches in diameter, and are of 100 horse power each. They are placed vertically, and the main driving pulleys are fixed on the turbine shafts. The capacity of this mill is five tons per stamp per day, or a total of 400 tons, and the value of the ore treated is about $30 per ton.

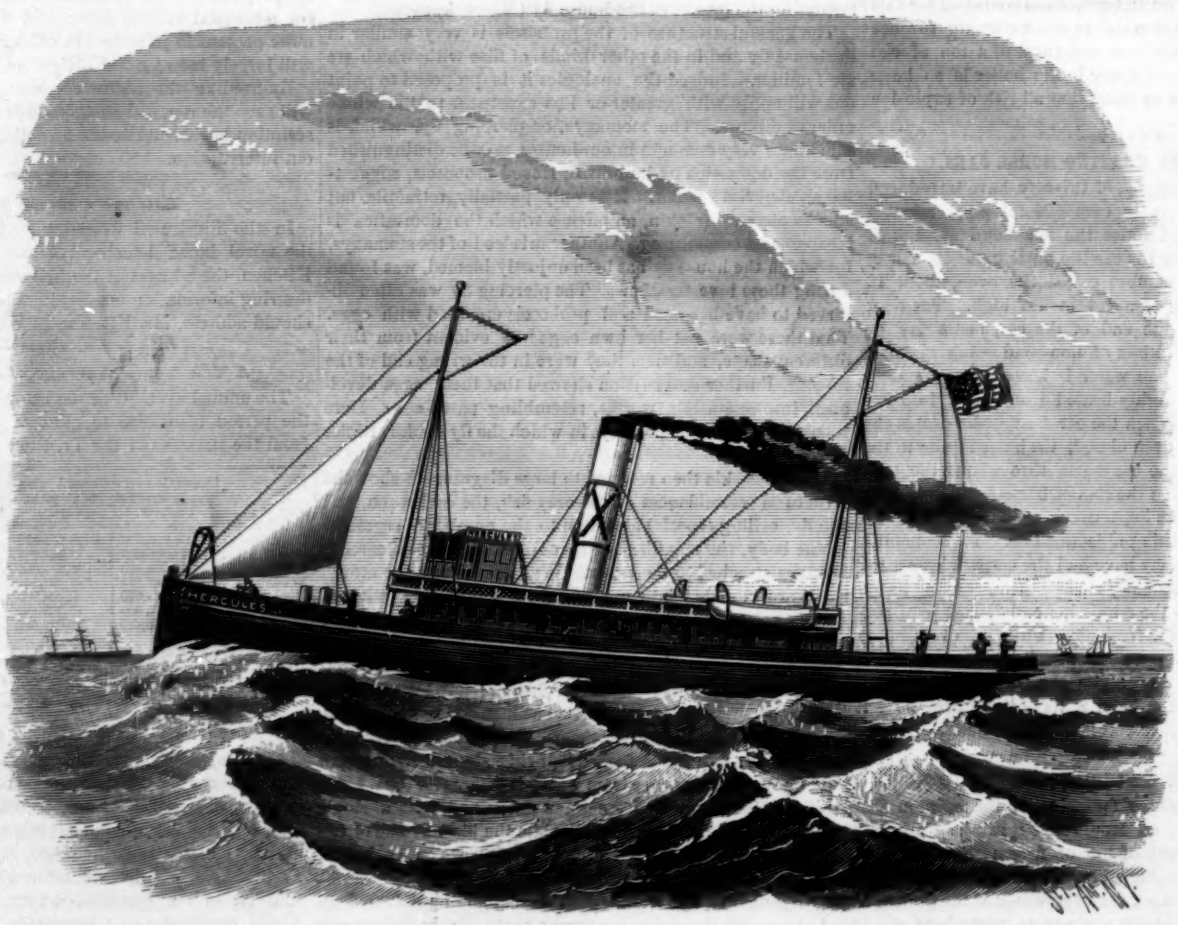
THE STEAM PILOT BOAT HERCULES.

Notice was taken, last week, of the latest phase of the ancient controversy between vested interests and new improvements, as shown in the contest over the steam pilot boat Hercules. This week we are able to place before our readers an engraved illustration of this much abused pioneer in a field in which such an innovation has long been needed.

The Hercules was built two years ago for a tug boat, and was constructed on the usual model for tugs of her size. She is 130 feet long with 25 feet beam. Since being adapted for the new service the Hercules has been completely overhauled and refitted, and berths have been provided for twenty-five persons.

The five pilots who have undertaken the task of introducing the new system, in defiance of their old associates, are W. H. Anderson, P. R. Bailler, G. Cisco, G. Mapes, and R. Noble. The new boat takes the place of the Widgeon, now retired, and receives the same number (10), as shown on the smoke stack.

The Hercules is intended for inshore service, and is expected to be of special value in times of light or contrary winds, when the channel is obstructed by ice, and on other occasions when steam has the advantage of wind.



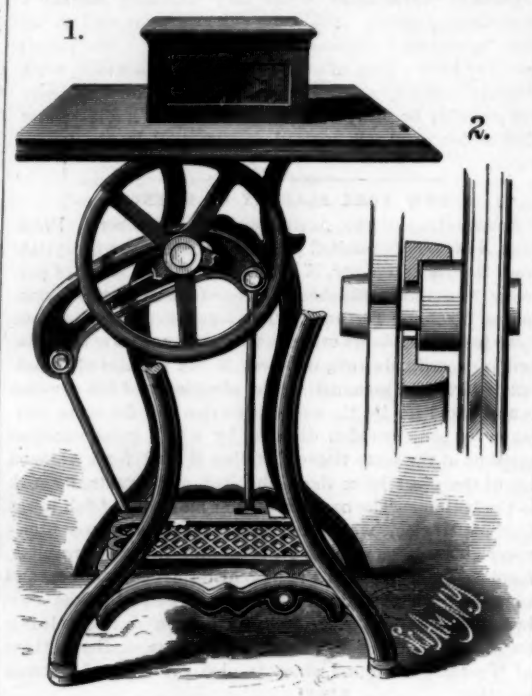
THE STEAM PILOT BOAT HERCULES.

A Moving Village.

A moving village is causing great alarm to the inhabitants of the department of the Hautes Alpes, in Southern France. Gradually within the last few years the village of Villard-d'Arenne has been slipping down hill. The church, built on solid foundations, has copied the example of the houses, the cemetery has followed suit, and so has a large neighboring hill. Heavy rains are believed to have undermined the ground, and dikes are being raised to prevent further damage, but they have not yet proved of much use.

NOVEL TREADLE MOTION.

A new and practical mechanical movement for propelling sewing machines is shown in the accompanying engraving.



ROMIG'S TREADLE MOTION.

It replaces the ordinary crank and connecting rod, and admits of either a rapid or slow movement. It also admits of a regular or irregular movement of the feet, and is practically noiseless.

The sewing machine balance wheel has a rubber covered boss which is revolved by contact with the reciprocating yoke. This yoke is connected with the treadle by two rods, one of which is pivoted to the toe of the treadle, while the other is pivoted near the fulcrum of the treadle. By pressing down upon the toe of the treadle the yoke is first brought into contact with the upper side of the wheel boss; it is then moved forward, causing the wheel to revolve. On pressing down the heel of the treadle the yoke is brought into contact with the under side of the wheel boss and is then returned to its original position, revolving the wheel as it goes.

By referring to the sectional view, Fig. 2, the relation of the yoke to the boss will be readily understood.

This novel device is the invention of Mr. John Romig, of Mifflinburg, Pa.

MISCELLANEOUS INVENTIONS.

Mr. Charles A. Righter, of New York city, has invented an improved card for use in putting up buttons for market. It is so made that several different styles of buttons may be attached to the same card in such a way that all or any desired part of either style may be detached without interfering with either of the others.

An improvement in apparatus for filling capsules, patented by Mr. Franklin E. Davenport, of Auburn, Ind., consists in a funnel, tube, and plunger. The funnel is flattened at one side to assist in taking up the material. The tube is adapted to receive the capsule, and is beveled at its end to aid in placing the same; and the plunger is fitted with an elastic collar, which prevents it from being forced too far into the tube.

Mr. James Kerr, of Church, County of Lancaster, England, has patented an improvement in apparatus for guiding and delivering woven fabrics to cloth finishing machines. It consists in a peculiar arrangement of two conical rollers, by means of which every deviation of the fabric to the right hand or the left causes a deflection of a frame and brings into operation devices which arrest or retard one of the rollers, thus bringing the fabric back automatically to its central position.

Mr. Thomas G. Brown, of New York city, has patented improvements in the construction of combination lock bracelets, the object being to enable the lock-bar or staple to be entered into the socket of the lock when the two parts of the bracelet are pivoted together, and it consists in connecting the lock-bar or staple with the end of the bracelet opposite to that on which the lock is placed by a concealed pivot, so that when the two ends are brought together the bar will turn sufficiently to enable it to enter with ease the straight socket in the lock.

Mr. James W. Smith, of South Schroon, N. Y., has patented an improved washing machine, which is so constructed as to wash the clothes quickly and thoroughly, and to allow any desired part of the clothes to be rubbed more or less as may be required.

Mr. Albert Clunan, of Brooklyn, N. Y., has invented an improved device for connecting the ends of leather, rubber, canvas, and other belt traces for harness and other bands and straps. It consists in combining a plate with a bar bent, threaded, and provided with an end nut.

Mr. Charles Bried, of Newark, N. J., has patented a mail bag fastening formed of four metallic strips of equal length, hinged together at the ends, having axes, with perforated arms on two of the strips and slots in the two opposite ones, having the axes adapted to be revolved so as to make the perforations in the arms coincide to receive the lock.

An improvement in sleeping car berths has been patented by Mr. Moritz Leiner, of New York city, N. Y. The object of this invention is to furnish an attachment for car and steamboat berths to facilitate entering and leaving the berths, and to prevent occupants of berths from falling or being thrown out. It consists in providing car and steamboat berths with ladders so constructed as to promote the convenience of passengers in entering and leaving the berths, and as guards to prevent the occupants of the berths from falling or being thrown out.

An improved implement, which will hold a rope or chain attached to the hook firmly and securely, has been patented by Mr. James Robertson, of East Cambridge, Mass. It consists in a hook formed of the screw shank and provided with a cylindrical nut made with an enlarged lower end, the hook arm having a grooved cavity or slot in or through the arm longitudinally in its upper or inner side, the eye, and the head.

An improvement in watch regulators, patented by Mr. Aloys Platt, of New York, N Y , is designed to provide a means for more easily and accurately moving and adjusting the regulator lever of a watch. It consists of a screw set upon the regulator lever and engaging in a screw groove made in the regulator bridge, so that by turning the screw the lever may be easily and delicately adjusted.

NEW PROJECTILE.

The annexed engraving shows a sectional projectile recently patented by Mr. I. L. G. Rice, of Cambridge, Mass. It consists of a main bullet having a conical end, and placed wholly within the cartridge shell, with its conical end pointing outward, and a sectional bullet composed of several parts, held in place by the cartridge shell. The sectional portion has a conical cavity adapted to the conical end of the main bullet, and there is a conical aperture in the outer end of the sectional bullet to allow the air to act upon the sections to separate them after they are discharged from the firearm.

RICE'S IMPROVED PROJECTILE.

The complete projectile is shown partly in section in Fig. 1, the main bullet is shown in Fig. 2, and the sectional part is shown in Figs. 3 and 4.

A New Photo-Printing Process.

M. Leon Vidal, in a letter to the *Photographic News*, says: Since I have had occasion to mention the name—a name never to be forgotten—of Poitevin, I should like to say a word on that gentleman's special process depending on the action of light on a layer of gelatine made insoluble by the following solution:

Water	100 cub. cents.
Iron perchloride	8 grammes.
Tartaric acid	1 gramme.

Gelatine, with which this solution is incorporated, is insoluble, but ceases to be so in those parts where light is able to act by reducing to its natural state the iron compound. I have not myself been able to make experiments on the very interesting reaction here indicated; but as it has been published by a man whose assertion on such a point it would be impossible to doubt, I can at once see very important results that follow from it. I can foresee here a means of producing carbon papers for special purposes; these could be sensitized from the very first, for all that is requisite is to have insoluble pellicles of pigmented gelatine, stored in a dry and dark place, where they could be kept for a long time without deteriorating. With this inverse method of working—I call it "inverse" because the action of light produces an effect quite opposite to that which it has when the gelatine has been sensitized by bichromate—we ought to be able to arrive at results of quite an opposite kind to those of the ordinary processes. Adopting this method in the Woodburytype process, as pointed out by M. Boivin, we might leave the film of gelatine in contact with the glass plate over which it had been flowed, and expose this upper surface against the negative The gelatine, which is at first insoluble, would become soluble to a depth corresponding to the greater or less transparency of the negative. Opposite a very transparent part a depression would be formed much deeper than in a place opposite a comparatively opaque part. The transparency produced would be positive; a moulding taken from it would be negative, and this, in its turn, would give the ordinary metallic plate of the Woodburytype. With a positive transparency a print could be taken serviceable for the first moulding

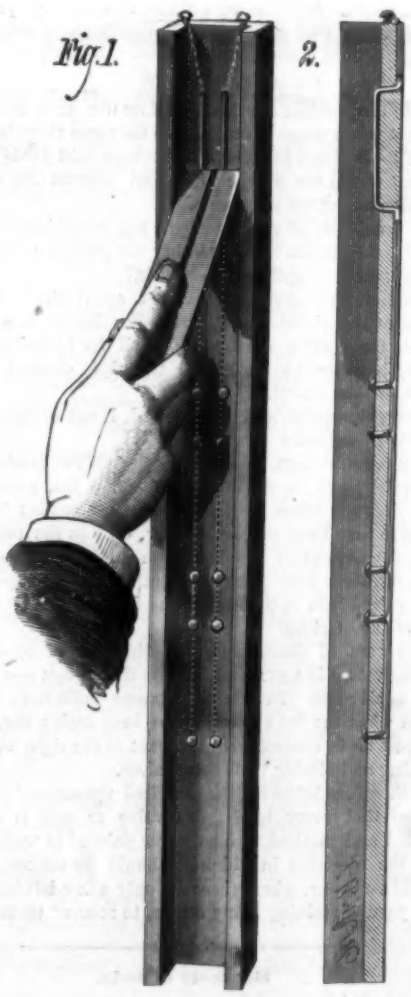
When applied to special kinds of carbon printing, or for the reproduction of line drawings, the layer of gelatine must be very thin, and not highly colored, and then the following action takes place: if it be exposed beneath a positive—for instance, a pen and ink drawing on thin paper—the light acts through all the translucent parts, but not on the parts beneath the lines. When sufficiently printed, it is only necessary to place it in hot water, and the lines alone will remain visible; the whole of the ground, which has been acted on by the light through the white paper, has become soluble, and has been washed away by the hot water. Hence we have the means of obtaining as a direct positive the reproduction of a drawing in black lines on a white ground. This application of the process appears to me to be of great importance, and to have a successful future in prospect. I believe, moreover, that in this country it will soon be worked on a larger and commercial scale. The experiments that it is my intention to make will, I hope, have practical results, which may be of great service to those endeavoring to work out such applications, and I shall be glad, so soon as I have completed them, to lay those results frankly before my readers. I have already discovered another means of applying this action to the production of the negative copy of a line drawing on a sheet permeable only in the parts corresponding to the drawing, and rendering by pressure the exact reproduction of the original drawing. The conclusion to which we are led by the arguments of this letter is: all honor to those who lay down the great principles! The discovery of the practical applications to which those principles can be put is merely a question of time. All honor to such men as Van Monckhoven and Poitevin!

A Railway up the Volcano of Vesuvius.

The railway for the ascent of Vesuvius is now finished It is 900 meters in length, and will enable tourists to ascend by it to the edge of the crater. The line has been constructed with great care upon a solid pavement, and it is believed to be perfectly secure from all incursions of lava. The mode of traction, says the *Engineer*, is by two steel ropes put in movement by a steam engine at the foot of the cone The wheels of the carriages are so made as to be free from any danger of leaving the rails, besides which each carriage is furnished with an exceedingly powerful automatic brake, which, should the rope by any chance break, will stop the train almost instantaneously. One of the chief difficulties of the undertaking was the water supply, but that has been obviated by the formation of two very large reservoirs, one at the station, the other near the observatory

ELECTRICAL SIGNALING INSTRUMENT.

In electric signaling apparatus, as usually made, some sort of clockwork is considered necessary to give uniformity to the movement of the interrupter. In the signaling instrument shown in the engraving no gearing or springs are required, and although it is of the simplest character it is found in practice to work equally as well as the more expensive instruments, and is much less liable to derangement. It is the invention of Mr William Hadden, of 145 Broadway, New York, and it consists in a plain grooved strip of wood or other non-conductor of electricity, containing contact points arranged in pairs and placed so as to represent any desired signal. These contact points are in electrical communication with the line wires or with a ground and the line, so that when any two of the adjacent points are simultaneously touched by an electrical conductor the circuit will be completed through the points and the conductor, and a signal will be received at a distant point. To facilitate the operation of sending the signal and to insure the contact of the metallic conductor, the latter is made of spring metal and split. The signal is given by drawing the spring circuit closer over the contact points from one end of the apparatus to the other. The movement of the hand is sufficiently uniform without making a special effort.



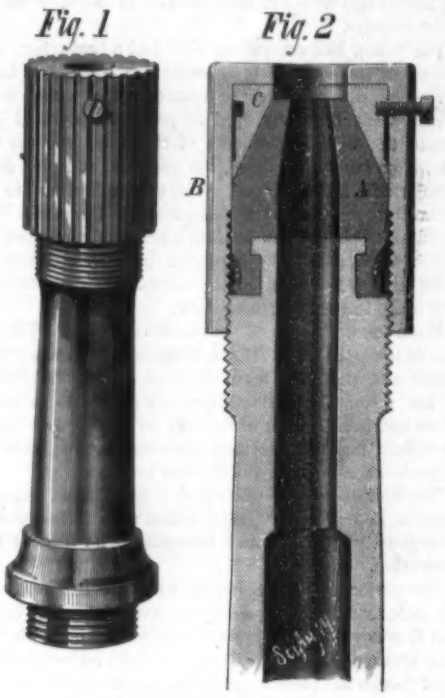
HADDEN'S SIGNALING INSTRUMENT.

This device is adapted to fire alarm telegraphs, district telegraphs, bell signals, etc.

IMPROVED HOSE NOZZLE.

The accompanying engraving shows in perspective and in section a new hose nozzle recently patented by Mr. George C Palmer, of Rochester, N. H. It may be adjusted to deliver a uniform stream of any desired size by turning the nozzle cap one way or the other.

A short elastic rubber tube, A, is secured to the end of the tube forming the main body of the nozzle, and is surrounded at its outer end by a conical washer, C, contained by the cap, B, which screws over the end of the body of the nozzle.



NOVEL HOSE NOZZLE.

The inside diameter of the rubber tube in its normal condition is the same as that of the body of the nozzle. When it is desired to diminish the stream the rubber tube is contracted by forcing down the conical washer, C, by means of the screw cap

Developing Gelatine Plates in Daylight.

The one drawback—and beyond question a serious one—attendant upon the use of highly sensitive gelatine plates, has been found in the fact that they could not be developed—or, in fact, uncovered for any purpose—in the ordinary dark room, illuminated with sufficient yellow light to permit of comfort in working. Extreme sensitiveness to feeble radiations has inevitably brought with it the risk of fog or abnormal action of light on the surface of the plate, if light possessing any actinic power whatever should come in contact therewith. The special claim of these plates is their sensitiveness to weak light, and that they are not wholly insensible to yellow light. Hence it should not be matter of surprise or impatience that they fog if opened or developed in the light of the ordinary dark room. To secure safety, it has been found necessary not only to reduce the area through which light could pass, but also to glaze that with deep ruby glass, two thicknesses being better and safer than one. With patience and practice it is not difficult to succeed with this small amount of light. But beginners often fail in the necessary precautions, and often, in consequence, blame the plates or the process altogether, and so fail to secure for themselves one of the greatest boons the art has ever placed within their power.

Mr. Werge has changed all this, and made development of the most sensitive plates easy in an ordinary sitting-room, or, at any rate, in a well lighted dark room. Among the many ingenious appliances exhibited at the recent South London technical meeting, none excited greater interest than the developing tray of Mr. Werge, in which he developed in the full gaslight of the room a gelatine plate which had been exposed in the morning, and exhibited to the meeting the result in a clean transparency, without fog or any trace of the abnormal action of light. The matter is, of course, very simple. The plate is developed in a covered tray, and is so protected from light. The arrangement consists of an ebonite tray, fitted in a casing of tin, grooved to allow a plate of ruby glass to slide in and cover the top of the dish or tray There is also an aperture for a funnel, through which is poured the developing solution, etc. What arrangement exists for watching the progress of development we do not know, as we have had no opportunity of examining the apparatus. This and some other matters are doubtless provided for. We can here simply record the fact, interesting to many, that the demonstration before the South London meeting was a perfect success.—*Photographic News.*

New Fashion.—Foot Jewels.

The bracelet slipper has been introduced in Paris. The shoe is cut very low in front and high up on the instep, it is fastened with a finely chiseled real gold bracelet instead of the usual strap. Another expensive novelty in the same line is the Andalusian boot, made of black satin, with lace ruffles down the front seam, and fastened with real jewel buttons.

Gradually within the last few years the village of Villard- | Mifflinburg, Pa. | the lever may be easily and delicately adjusted.

AMERICAN INDUSTRIES.—No. 26.

THE MANUFACTURE OF PIANOS AND ORGANS.

The history of the development of the pianoforte reaches back more than a century and a half, and possesses considerable interest on account of the adoption of the instrument in almost every household. The most ordinary of modern pianos, compared with those used by Haydn, Gluck, and other composers and artists of the eighteenth century, are immensely better in tone, in size, in elegance, and in all other respects.

The piano, like everything else, had a beginning, and the history of the class of instruments from which it has been developed dates from the remote time when stretched strings were first employed in producing musical sounds. One of the early instruments of this kind was the ancient lyre, from which the harp, the psaltery, and the dulcimer were gradually developed. The clavicitherium, or keyed cithra, was the first marked approach to the piano. It consisted of an oblong box holding a series of stretched strings, which were struck by a plectra of quill attached to the inner ends of the keys. This instrument, it is believed, was first made in the twelfth century.

From the first days of the clavicitherium until the invention of the action, in 1711, the instrument was made in many forms, and took on as many different names. The invention of the action, by which hammers are made to strike the wires and fall back out of the way so as to permit the string to vibrate, has been ascribed to several persons, and there is great doubt as to who was the real inventor.

The first pianos manufactured in the United States were made in Boston in 1822, since which time the instrument has been greatly improved and brought to its present state of perfection.

The parlor or cabinet organ, which is the outgrowth of the melodeon, has been perfected within the last few years, and is now made in a great variety of forms, with different stop arrangements, and at prices so low that but few families need forego the pleasure of music in the household.

For many years a few old established houses controlled the business of piano making and selling; but latterly competition has increased, and new modes of doing business have been inaugurated, some of which have been very advantageous to the buyer and user. The largest manufacturer in this country doing business directly with retail purchasers is Mr. Daniel F. Beatty, whose factory we illustrate on the title page. The idea of dealing directly with the users of the instruments is a recent one, which not only benefits the buyer, but the manufacturer also, as it enables the manufacturer to sell a better instrument for less money than he could if agents were employed.

The central view at the top of the page represents Mr. Beatty's new factory, situated on Railroad Avenue, corner Beatty Street, in the city of Washington, New Jersey. The small building in the foreground is the office belonging to the factory. The larger building is the new factory. The building seen some little distance behind the new factory is the Beatty Building, a spacious structure, containing in addition to the hall proper, the office devoted to the extensive business connected with the piano and organ factory. The large building in the distance at the right is Beatty's Factory, No. 3. Samples of the products of these factories are shown in either of the upper corners. We have chosen a few only of the departments of this concern, as space will not permit us to enter into all of the details of piano and organ manufacture.

While the case of an organ is little more than an elegant piece of cabinet furniture, the case of a piano must not only be as elegant and well finished as skilled labor can make it, but it must be very strongly made of the very best of materials to insure its durability. The iron frame, which is to withstand the stress of the wires aggregating many tons, is fitted to the case; the sounding board is also supported by the case. In the assembling room the wires are placed on the pins, the action is fitted, the soft and loud pedal mechanism is put in, and the instrument is turned over to the workman who adjusts the action, then to the tuner, who puts the strings under their normal strain. The strings stretch somewhat; this, taken together with the slight but unavoidable yielding of the frame, soon throws the instrument out of tune, so that it requires tuning again and again. Finally, when it is capable of standing in tune, it is given to the final inspector, who gives it the last touches, which make it a complete instrument.

The organ is so entirely different from the piano in every respect that it requires workmen of altogether different qualifications. The actions—consisting of the keys, the nicely fitted valves, and the delicate springs which hold the valves to the seats—are made in the department shown in one of the lower engravings. It is with the utmost care that each piece is fitted in its appropriate place, and the workman, when he leaves one part to go to another, knows that what he has finished is well and perfectly done. Without this care on the part of the workman there would be no end to difficulties, and the work would never be completed.

The small central figure in the lower part of the engraving represents the room in which the reeds of the organs are tuned and voiced. The workman in this department must not only be a careful and experienced mechanic, but he must have a correct musical ear and a faculty of distinguishing between the shades of quality in a tone. Upon this workman depends all that is pleasing in an organ, as he has it in his power to make the tone soft, sweet, and mellow, or harsh and unpleasant.

Everything in this factory is conducted on a perfect system. None but the best of workmen are employed, none but the best of materials are used, and the most modern machinery and appliances are adopted to facilitate the work and to render it not only cheaper but better.

Mr Beatty's offices are extensive and well appointed It requires twenty or more assistants to attend to the details of this immense business The advertising bureau alone keeps a goodly number of persons constantly employed

The business, started but a few years ago by its proprietor without a dollar, has grown beyond all precedent, amounting at present to several millions of dollars a year.

Mr Beatty was lately elevated to the Mayoralty of Washington entirely without his own seeking. His fellow-citizens chose him. He conducted no campaign, and was not even present on election day, business having called him to New York on that day, and the news of his triumph was telegraphed to his headquarters at the Fifth Avenue Hotel. He bears his honors modestly, and his neighbors testify to his being the same genial, open-handed, free-hearted man as ever, not forgetting to relieve the unfortunate, to give freely to his church, nor deeming it beneath him to preside at Children's Day services in his own church.

The Beatty piano and organ are everywhere known. Mayor Beatty's success has been rapid and complete, and he claims to possess to-day the largest manufactory of pianos and organs which sells directly to the people.

Winter Precautions for Hydrants, Valves, Etc.

On the 1st of November Mr. Edward Atkinson, President of the Boston Manufacturers' Mutual Fire Insurance Company, issued the following to the mills insured in that company:

Many of the yard hydrants and those connected with standpipes are of the variety known as Y or branch hydrants, and are not provided with means of draining off the water when the hydrant is closed.

When the fire pumps are used for inspection, or for the drill of the fire organization, water remains in the upper portion of such hydrants as were closed before the pipes were drained; and also forces its way into the upper portion of every hydrant that does not remain perfectly tight under the heavy pressure. The hydrants are generally tight enough to retain this entrapped water, and the hydrant caps prevent its evaporation.

Our inspectors have discovered many instances of broken hydrants, several of broken pipes, and two of rotary pumps injured by the freezing of entrapped water, during the last year; while, undoubtedly, a larger number of similar cases were discovered by those in immediate charge and promptly repaired.

The hazard of a single broken hydrant does not lie so much in the possible deprivation of its use, as it does in the fact that when water is forced into the pipes there is a great risk of the hydrant breaking; and in most mill yards such an accident would tap all the pipes and prevent the efficient operation of the fire apparatus.

The possibility of such accidents can be obviated by opening all the hydrants when draining the pipes for the winter months and closing them afterwards.

It is therefore suggested that each agent shall, either on receipt of this circular or at such other time as he sees fit to prepare for freezing weather, cause all the hydrants of the description named to be opened, the pipes drained, and the hydrants then closed.

Rotary pumps should be emptied, if not submerged, by turning them backwards.

In this connection, we also urge that all left-handed valves and water gates be distinctly labeled, as many cases have been observed where the valves have been broken by an attempt to turn them the wrong way, even in the presence of our inspectors when causing them to be examined; some great disasters have occurred from the mismanagement of such valves both in premises insured by us and also outside of our line of risks.

The want of similarity in the direction of opening and closing valves is a great misfortune that cannot now be remedied in all cases. In several instances mills have been wet down when the fire apparatus has been under test, because the persons in control were ignorant of the right method of opening and closing their own valves.

It therefore behooves the principal manager of every mill to see that every left-handed valve or gate is distinctly labeled and marked with an arrow painted in white to indicate the direction in which it should be opened; or what would be better, where there are only a few left-hand valves in a yard containing many others, to remove them entirely.

Benzoate of Soda.

Professor Klebs, of Prague, announces that the benzoate of soda is the best antiseptic in all infectious diseases. It acts, as the experiments of the author show, very powerfully. It is claimed that a daily dose of from 30 to 50 grammes to a full-grown man will render the poison of diphtheria inoperative. The benzoate is prepared by dissolving crystallized benzoic acid in water, neutralizing at a slight heat with a solution of caustic soda, drying, and then allowing the solution to crystallize over sulphuric acid under a bell glass. Large doses do not appear to be absolutely necessary. Good results may be obtained by the daily administration of about 12 grammes.

AGRICULTURAL INVENTIONS

An improvement in plows has been patented by Mr Charles T. Crook & Logan J Huffman, of Fort Mill, S. C This plow has a bifurcated foot for a plowshare that will allow of the raising and lowering of the share at will, and is so adjusted as to prevent the clogging of both foot and plowshare from grass, litter, etc

An improvement in sulky plows has been patented by Mr. Aden K Munson, of Marysville, Kan. The object of this invention is to provide for vertical movement of the plow beam independent of the sulky, so that the plow will run at a uniform depth, and also for leveling the plow sidewise on uneven ground, and to provide for shifting the supports of the plow beam bodily on the axle of the sulky for adjustment to the size of plow and the desired width of furrow

Mr Joseph P Prairie, of Raleigh, N. C, has patented an improved machine for chopping and cultivating cotton. It is so constructed that it may be used for chopping, for chopping and cultivating, or for cultivating alone, as may be desired.

The Fruit of Shrubby Trefoil as a Substitute for Hops.

All who are acquainted with the tall shrub called "shrub by trefoil" (*Ptelea trifoliata*) know that its fruit is bitter, and in odor is almost exactly the same as the hop. In fact the fruit is sometimes used in this country as a substitute for the latter; and for this reason the plant is also known as the "hop tree." In consequence of the ravages of the phylloxera the French are now looking about for new beverages, and, as observed in the *Revue Horticole*, if the destruction of the vine continues there is no doubt that wine must be largely replaced by beer. M. Charles Baltet has discovered that the fruit of the "shrubby trefoil" makes equally as good beer as hops. At a recent agricultural exhibition at Châlons-sur-Marne, a M. Ponsard exhibited a sample of beer in which the fruits of this plant were substituted for hops, and its quality and flavor are reported as being equal to those of the best Strasbourg beer. As above stated, the fruit of the *Ptelea* is sometimes used in the United States as a substitute for hops, but whether it has ever been so used in the manufacture of beer, we are unable to say.

The World's Commercial Marine.

According to the *Répertoire Général*, Bureau Veritas, for 1879–80, the sailing tonnage of the civilized world has decreased from 14,218,072 to 14,103,605—a falling away which shows the decided tendency which now prevails to give steamers the preference over sailing vessels. The total sailing tonnage of Great Britain, which includes colonial tonnage, is 5,584,128, so that considerably more than one third of the tonnage which sails the sea is under the British flag. When we come to steamships, Great Britain takes a still prouder position. The total number of steamers which can be classed as sea-going is 5,897, of which Great Britain has 3,543; and the total net tonnage of steamships is 4,021,869, of which Great Britain has 2,555,575 tons, or about three fifths of the whole. Counting sailing vessels and steamers together, the civilized world has 18,125,474 tons afloat, of which 8,139,703, or not much less than half are under the British flag. Canada occupies the fourth position among nations. The leading nations are Great Britain, United States, Norway, Canada, Germany, Italy, and France.

Artificial Botten Eggs.

Mr. J. Fletcher, F.C.S., recently described a new method of preparing sulphureted hydrogen. The plan is simply to fuse sulphur and solid paraffine in a small glass flask, leading the resulting gas by means of a perforated cork, India-rubber, and glass tube directly into the solution to be tested. The first gases are not sulphureted, but when the mixture has been thoroughly fused and mixed the sulphureted hydrogen passes over abundantly. The advantage of the process is that the moment the flame of the lamp is removed the evolution of gas ceases, and the little apparatus can be laid aside without fear of creating offensive smells. When used again, the gas passes at once when sufficiently heated. There are few precautions to be taken The mixture is inclined to BUMP when strongly heated, but a few pieces of broken tobacco pipe shank prevent it. Care must be taken that when the lamp is removed and the gas ceases to pass, none of the solution is sucked back into the bulb; it is very easily prevented. A very strong heat should not be applied, as then distillations would commence and the product condense in the tube.

National Exhibitions.

The years 1880 and 1881 will both be marked by two national exhibitions—the one at Brussels, the other at St. Petersburg. The preparations for the Brussels Exhibition, which will be opened next May, are in a very forward state, and the building will be handed over by the contractors before the end of December. The total space at disposal is 66,000 square meters, one half of which will be devoted to the arts and industries of the past, the other half to modern industrial arts and sciences. All the Belgian industries will be fully represented, including those of agriculture and horticulture, and there will be an additional space of 16,000 square meters set aside for a show of live stock. The Exhibition will be fourteen times as large as the one of 1874 held in the Halles Centrales. The Russian Exhibition is also proceeding rapidly, as far as the building is concerned, and the ironwork is being made at the St. Petersburg foundry.

Changes in the Appearance of Jupiter.

Writing with reference to the strange belt on Jupiter, in a communication dated September 28, Mr. J. A. Brashear, of Pittsburg, Pa., says:

"I first saw it at 2:45 A.M. on the 26th of June. A nine inch silvered glass Newtonian telescope was used in this observation. The belts on the equator were of a beautiful pinkish brown color. The broken belt noticed by your correspondent was so vivid and clear that it reminded me of a coke fire seen on a dark night. It made such an impression on my mind that I at once made a sketch of it, which has been of great value in subsequent observations. In referring to my note book I find I have eight drawings of the planet since the above date. Comparing the last drawing with previous ones, I am led to believe that the spot has slowly diminished in size, though not in general outline. Another and still more strange phenomenon has occurred, and to this I should like to call the special attention of observers. In my drawings I have located the white spots plainly visible between the equatorial belts, and by comparing the consecutive sketches I find that either the spots or the red belt has shifted in reference to one another about one-fourth the length of the red belt.

"Any one who has read Camille Flammarion's interesting article on Jupiter in the last number of your SUPPLEMENT, will see that this shifting of the spots is no new thing, but the question is, Which belt or spot has shifted? I am inclined to think, with my esteemed friend, Mr. F. W. Very, assistant to Prof. Langley at the Alleghany Observatory, that it may be some terrific action is going on in a local spot beneath the red belt which has dissipated or torn away the vaporous envelope of the planet over the place of local disturbance, and we possibly see the *actual surface of the planet* beneath or through the rift in the vaporous envelope. If this conjecture be true, then it is more than likely that the shifting has been in the white spots beneath the equatorial belts, as the local action which gives us the red belt would hardly be of a shifting character. I have used 6·5 inch, 9 inch, and 12 inch aperture silvered glass telescopes, and 4 inch and 13 inch achromatics, at different times of observation, and have had some exquisite views of this marvelous planet and its attendant panoramic phenomena."

A FUNGOID GROWTH—THE CAUSE OF WHOOPING COUGH.*

(*Tussis Convulsiva, Pertussis.*)

BY HENRY A. MOTT, JR., PH.D., F.M.

The idea has prevailed, and in fact is still prevalent now to a very great extent, that whooping cough must run its course, or that it has a definite limit; and if the cough is broken up it would be much worse for the child, for it would be laying the foundation for some fearful disease in the child's system. To this conclusion, I fully believe, can be attributed much of the mortality among children. The deaths from whooping cough, according to Condie, are 1 to 83 of the entire mortality in Boston, 1 to 46 in Charleston, 1 to 95 in Baltimore, 1 to 63 in Philadelphia, and 1 to 64 in New York.

When we consider such figures as these, surely any effort made to discover the cause of this terrible disease, and to point out the proper line of treatment, should be met with a hearty reception. Much diversity of opinion has existed in regard to the pathology of whooping cough. Fortunately, however, owing to the investigations of Dr. Letzerich, of Germany, in 1871, and the confirmation of his results by myself, our knowledge of this disease has been greatly enhanced. Condie says: "A majority of the most authoritative writers refer it to bronchial inflammation, which, by few, is considered to be of a specific character. By some, however, who have written very ably upon the disease, the bronchial affection is viewed as a mere concomitant, or effect of the whooping cough; and not in any degree essential to its existence. Most of the writers refer it either to disease of the pneumogastric or phrenic nerve, or to disease of the brain affecting the origin of the respiratory nerves; while others consider cerebral irritation to be secondary to the bronchial disease, and oftener absent.

"That the essential symptoms of whooping cough are the result of a spasmodic closure of the glottis there can be but little doubt, but whether this is owing to an irritation seated in the larynx or trachea, or in the brain, it is difficult to determine." In pathology so uncertain as this, how are the proper remedies to be selected? Are they to be addressed to the brain, the origin of the nerves, or to the larynx or trachea?

The question having only recently been answered, among the former remedies are found purgatives, astringents, emetics, expectorants, narcotics, vesicants, tonics, depletants, antispasmodics, caustics, revulsents, antiperiodics, ablutions, etc. As Dr. J. O. Hamilton, in his able article* on whooping cough, remarks: "How can we imagine such a hydra-headed disease, requiring such fearful instruments for its decapitation?" From the above it is certain that Dr. R. Dugleson, in his work on disease of children,† stated the truth when he said, "But little is known of the cause of whooping cough."

As stated before, in 1871 Dr. Ludwig Letzerich commenced a series of microscopical investigations as to the real cause of whooping cough, and his original investigations are to be found in full in Virchow's *Archiv*, vol. 49, p. 530.

* Read before the New York Academy of Sciences, November 24, 1879.

† Illinois State Med. Soc. Rep., p. 48, 1875.

‡ Page 299.

Letzerich showed, for the first time, that if the expectorated mucus whooped up during the short duration of the first catarrhal-like stage of the disease, be examined under the microscope, there will be seen, besides the portion of phlegm, etc., etc., small elliptically-shaped brownish-red fungus spores, some of which have partially germinated and brought into existence mycelium. This discovery gave a clew at once to the cause of pertussis, and opened a new channel for its treatment.

As the editor of the *Quarterly Journal of Microscopy* stated that this observation of Letzerich had not as yet been confirmed by any other investigator, and having an opportunity offered to study the disease in my own children, I concluded to do so, and after a careful microscopical investigation of the phlegm whooped up at various stages in the development of the disease, I can now state that in the main my investigations confirm those of Letzerich.

The following is an illustration of the fungus spores and the mycelium. Of course no one slide gave the field here presented, but it is the result of the examination of a very

large number. A represents the mycelium; B, cells thrown off from the epithelium; and C the fungus spores, which exist in great numbers; D represents a film of epithelium from the under surface of the epiglottis. Letzerich represents the fungus spores when developed as brownish-red. These I did not detect.

The ripe spores of whooping cough differ from those of diphtheria in not being circular, and in not showing any finger-like protuberances. The growth of the mycelium in the masses of phlegm goes on very rapidly, and the threads acquire considerable length, especially when the disease is at its height. The expectorated mucus is also very thick at this stage, and on drying becomes of a glassy appearance, although quite tenacious. In these latter stages the mycelium are very plentiful, and there is an energetic formation of spores. If the fresh spores are treated with iodine and concentrated sulphuric acid, the mycelium are colored beautifully blue, and the unripe spores, which are white, now appear brown. To show how this theory was received by Dr. Hamilton, who made such a careful investigation of all theories, I will quote what he says: "The only theory that seems to me tenable, and I think the success of certain remedies bear it out, is that whooping cough is the direct result of a fungous growth; that the spores are thrown off by the individual coughing, and are received by another in the saliva of the mouth, which retains them until they have time to attach themselves to the underside of the tongue, where the mucous membrane is the thinnest and softest of any part of the mouth, and at the same time are not so liable to be dislodged by drink or food. In this situation they remain until they are able to germinate and spread along the sides of the tongue and backward until they reach the larynx and pharynx, when the full whoop is established. Elevations or lumps can very plainly be seen under the tongue before the patient begins the whooping, but the catarrhal symptoms at this time are quite prominent; discharges from the nose, suffused eyes, headache, some fever, and general lassitude. The time of incubation is from nine to fifteen days, though varying in the different subjects. These elevations on either side of the frænum linguæ are small, and might escape observation unless carefully sought for, as it is quite difficult to induce the young subject to turn the point of the tongue up long enough to make proper observations."

Letzerich made numerous experiments on rabbits with the spores from whooping cough. The spores were cultivated on pieces of bread soaked in milk, and then introduced into the trachea of young rabbits for future development. This was affected by tracheotomy, but the animals rapidly recovered from the effects of the operation, and in a short time became affected with a cough—the same as whooping cough. The rabbits were killed, and their air passages and lungs were found to contain enormous quantities of fungus; the expectorated mucus was also the same as in man.

From Letzerich's valuable investigations he was able to show the difference between the action of fungus in diphtheria and that in whooping cough. He says: "Disease produced by the vegetation of fungi in the epithelium stratum of the respiratory organs are of two kinds. 1 *Diphtheria:* The vegetation of the fungus originates at the head of the windpipe and trachea, seizes and destroys the epithelium with startling rapidity. 2. *Whooping Cough:* The fungus germinates in the epithelium web; at first in the upper part, and then over the whole respiratory organs, without destroying the web, produces whooping cough and its manifest complications. If the growth of the fungus is confined to the epithelium of the epiglottis, of the larynx, and trachea, then it is simply whooping cough; but if the fungus enters into the delicate bronchial tubes and the cavities of the lungs, then the dreaded complications arise."

It is therefore best to meet the disease in its earliest stages and treat it properly; that is, with an object to kill the fungus and prevent its further development; and then we shall seldom have the complications of bronchitis, cholera infantum, or cerebral difficulties to contend with.

What, then, shall be the proper remedy? Quinine has been used for a long time with excellent results, but its use was not founded on the fact that it kills fungus plants. It was not so used until 1869, when Professor Binz made numerous experiments to show that it would check very markedly the alcoholic fermentation in various fluids; and that the antiseptic action was due to the poisonous influence of the drug upon the fungi, which are the cause of such fermentations. According to his experiments the largest infusoria are killed by a solution of quinine of the strength of 1 in 800 immediately, and upon the ordinary mould penicillium, upon vibrios and bacteria the drug acts with a similar fatality.* In the latter part of 1870 Prof. Binz, and later in the same year Breidenbach, published articles on the beneficial action of quinine in the convulsive stage of pertussis.

Their application of this drug indicated that they thought pertussis was due to the growth of fungi; but still this had never been demonstrated until Letzerich undertook the investigation. In 1871 Steffin confirmed in the main the accuracy of the observations of the savants mentioned above, and two years later Dr. B. F. Dawson reported eighteen cases in a valuable pamphlet, and advocated strongly the value of quinine in curing the whooping in this disease. Since then the use of quinine has been ably defended by Dr. Hamilton, of Jerseyville, Ill., and by Dr. Charles W. Earle, of Chicago. My experiments lead me to the same conclusion, as after administering quinine to my children, and in fact to numerous other children, they all speedily recovered, not whooping more than once a day after the second day it was given them, and discontinuing to whoop entirely by the end of the fifth to sixth day. The time could be made much shorter if children could be induced to take it in a powder directly on their tongue and let it dissolve slowly; but owing to its extremely bitter taste they object. So I found by dissolving the quinine in "gum"—that is to say, sugar and water—they soon became accustomed to the taste and craved for it, as as it afforded them relief.

The best time to administer it is just after a coughing spell and just before retiring at night. As regards the size of the dose, this should depend on the age and severity of the case. To a grown person, from three to five grains of powdered quinine can be put right on the tongue and allowed to dissolve itself. To a child from two to five grains may be dissolved in two ounces of gum (sugar and water), and one teaspoonful can be given as stated above. The gum helps to keep it in contact with the parts longer. Quinine administered in gelatine or sugar-coated pills is of no use whatever.

* Virchow's *Archiv*, 1869, p. 68. Wood's Therapeutics, Materia Med. and Toxicol., p. 69.

Sound Waves.

C. Decharme has extended the investigation of nodal systems, and drawn some interesting comparisons with the earlier researches of Chladni, who indicated three systems of nodal lines: the diametral, the concentric, and the compound. He substitutes a thin layer of water or some similar liquid for the sand which Chladni employed, and finds many interesting relations among the peripheral and eccentric networks, the number of sonorous vibrations, the breadths of the striæ, the areas of the internodal sectors, and the numbers of nodal divisions. By means of these equations it becomes easy to estimate the wave lengths of different sounds.

K. H. Schellbach and E. E. Boehn have experimented with waves of sound, in illustration of the wave theory of light. Connecting two Leyden jars with the conductors of a Holtz electrical machine, so as to produce sparks of 1 centimeter (0·39 inch) between the balls of the discharger, concentric rings were formed in coal dust sprinkled on a glass plate 4 centimeters (1·57 inch) from the balls. The longer the spark the more strongly marked were the rings. By reflecting the reports of the discharges, by means of parallel walls and mirrors of various kinds, the dust waves were made to assume such forms as are theoretically deducible from the reflection and refraction of light, thus visibly confirming the views of Huyghens and Young. That the results are not modified in any way by mere electrical action can be readily shown by substituting explosive gas or powder for the sparks. From ten to twenty sparks or explosions were generally sufficient to show the character of the waves and of their nodal intersections.—*Ann. d. Phys. und Chem.*

and unpleasant.

administration of about 12 grammes.

ironwork is being made at the St. Petersburg foundry.

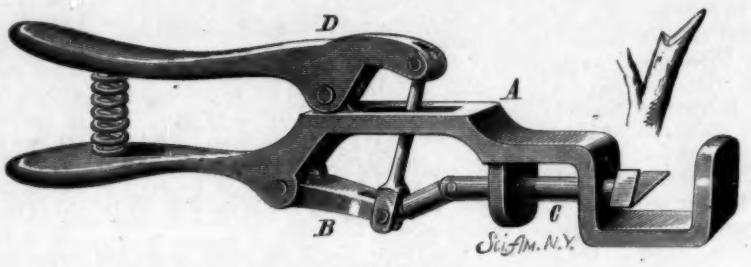
PRUNING AND GRAFTING IMPLEMENT.

The tool shown in the engraving is designed for grafting and pruning, the knives being changeable, so that it may be readily adapted to either purpose.

The main portion, A, of the tool contains a toggle joint, B, connected with the sliding bar, C, which carries the knife. A lever, D, pivoted to the part, A, is connected by a link with the toggle joint, B, completing an arrangement of levers capable of moving the knife with great force as the handles of the implement are brought together.

The part, A, is bent to form a support for the limb to be cut, and the support is lined with wood or soft metal to prevent injury to the knife.

The knife represented in the engraving is V-shaped, and the cut made by it is shown in the little detail view. This form of cut is made in grafting. This tool is the invention of Mr. Charles M. Kingsbury, of Tama City, Iowa.

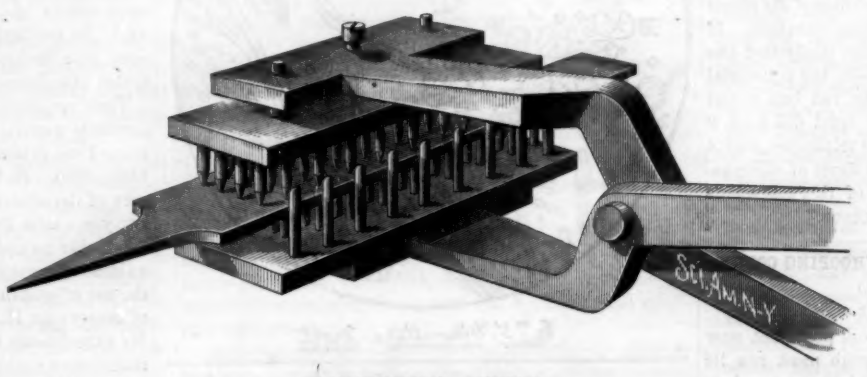


NOVEL PRUNING AND GRAFTING IMPLEMENT.

IMPROVED HARDENING TONGS.

The annexed engraving represents an improved implement for holding and manipulating steel articles during the process of hardening. It consists in a pair of tongs having T-shaped jaws, provided with pointed pins which bear upon opposite sides of the article, and prevent it from twisting out of shape when it is plunged into the water to cool, while it allows the water to completely surround the article and cool it as readily as it would if it were plunged in the usual way. One of the jaws is movable and is capable of adapting itself to tapering surfaces.

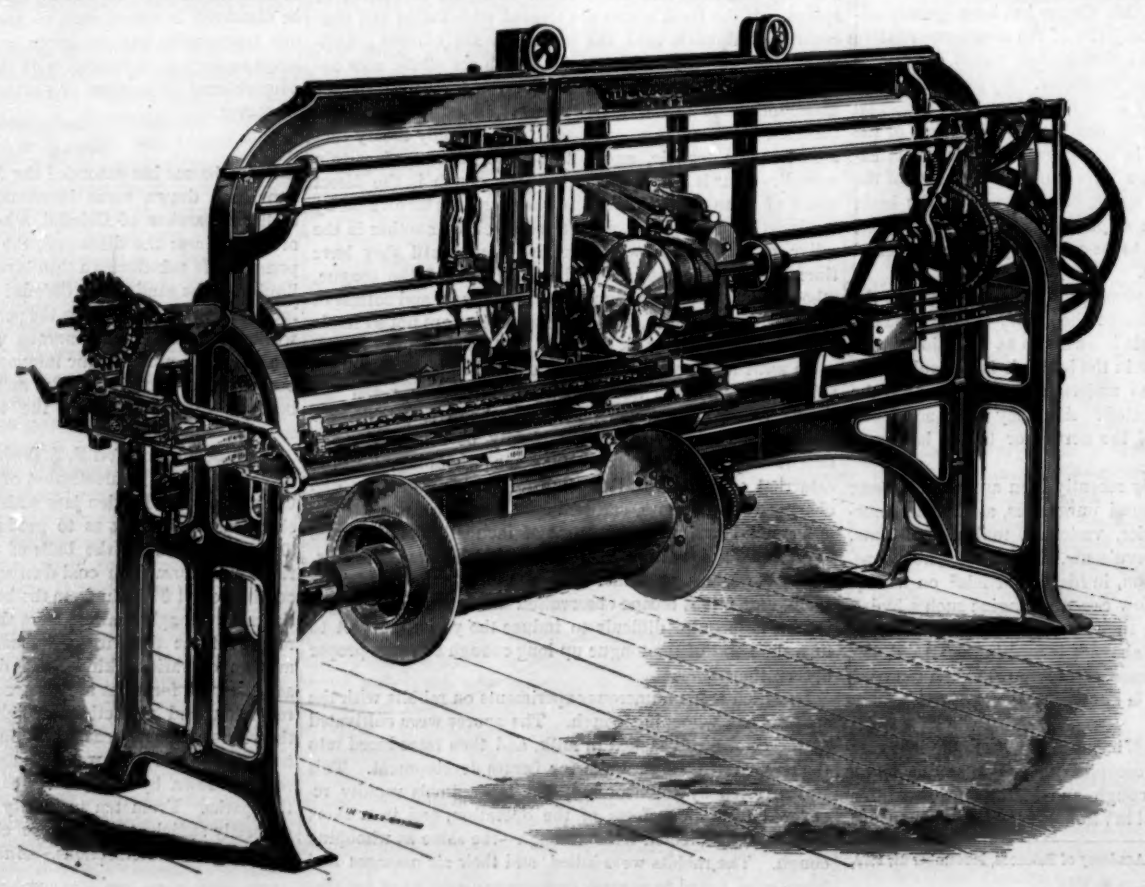
This implement is the invention of Biel Le Doyt, deceased. The patent is issued to Mary M. Taylor, administratrix, Mansfield, Mass.



HARDENING TONGS.

TYING-IN MACHINE.

The tying-in machine shown in the accompanying engraving is the invention of Messrs. J. P. Binns and J. Shackleton, and is made by Messrs. Greenwood & Batley, of Albion Works, Leeds, England. It is designed for tying-in the new warp to the old in weaving operations, or connecting each end or thread of the new to the ends or threads of the old warp, so as to allow them to be drawn through the mails or eyes in the healds or harness and sley or reed. Until the present time this operation of tying-in has been done altogether by hand, either by taking the two ends of each thread separately and tying them together, or, as in the manufacture of fine goods having a light and elastic warp, by twisting them together. The object is satisfactorily effected by the machine, working entirely automatically and by power, making a secure knot, and thus performing with accuracy and dispatch what was previously a tedious hand operation. The machine, well illustrated by the engraving, has a suitable framework, on one side of which is placed the warp beam with the new warp upon it, and on the other side the healds or harness and sley or reed, with a portion of the old warp in them, the ends or threads being secured to rails, and extending across or lapping over each other sufficiently to allow for the forming of the tie. A carriage is mounted upon the framework, sliding upon rails or rods, and capable of being moved laterally or crosswise of the warp threads. The framework also supports a rotary horizontal driving shaft, which the carriage slides upon, and which carries and gives rotary motion to a barrel having several cams attached to it for operating the various levers which control the movements of the working parts of the machine. This carriage supports a vertical reciprocating slide bar carrying a needle or hooker by which the threads are seized and placed in position to be tied together, the bar receiving its motion from one of the cams already referred to and a suitable lever. Another barrel or hollow shaft is supported on this carriage, receiving rotary motion from the driving shaft, and on one side of it is a boss. A sliding finger is mounted on the outside of the barrel, carrying a cam at one end, and a reciprocating sliding needle within the barrel is operated by another cam and lever. Intermittent motion is given to the carriage across the warp by a screw shaft which is worked by a ratchet wheel and catches. Knives are furnished for cutting the ends or threads of the warp, at the time required, to the proper length for tying together. There are four horizontal shafts, each carrying a half flange or finger for freeing and separating the warp threads. These shafts are geared together at one end, and intermittent rotary and reciprocating motion is imparted to them by means of a cam with lever and rod, working in connection with ratchets and catches, and operating the screw bushes or bearings of the shafts. In the framework of the machine are two guide pins for the vertical needle to pass and draw the warp threads between after being cut, keeping them together and holding them while the finger on the rotary band turns them around a curved groove in the boss on the end of the barrel to form the loop. When the loop is formed, the sliding needle within the barrel draws the ends of the threads through the loop, and a lever is brought into operation, pushing the loop off of the boss, drawing the threads tight against the holding of the needle, and forming the knot. The knotted threads are removed by a finger, the next threads are in turn taken up, and the operation is continued until the whole of the warp is tied in. A self-acting stop motion is attached which stops the machine should a knot be missed, thus securing good work, and insuring that all the ends of the new warp are attached separately to those of the old.



TYING-IN MACHINE.

MECHANICAL INVENTIONS.

Mr. Henry C. Green, of Bascobel, Ga., has patented an improvement in the class of windlass presses, or presses whose followers are operated by a system of ropes and pulleys. Instead of placing a windlass shaft at each side of a vertical press box, as usual heretofore, the inventor arranges a wheel horizontally beneath the bed of the press, and provides it with a lever attachment, by which it is rotated and caused to take up or wind on the ropes connected with the follower.

Mr. Martin W. McCortney, of Mount Pleasant, Mich., has patented a single cylinder double acting force pump for wells, of novel construction, having its valves and connections fitted in a simple and durable manner, and so as to be readily accessible.

An improvement in that class of drag saw machines in which the saw is attached to a lever that is pivoted in a frame and vibrated by a hand lever, has been patented by Mr. William N. Kyle, of Edinburg, Ind.

An improved windmill, patented by Mr. Ratti Lorenzo, of Loyalton, Cal., consists of vanes affixed to a carriage adapted to move freely on an incline attached to the pivoted head of the mill, and extending backward parallel to the face of the wheel, whereby, when a strong wind is blowing, the carriage is forced out on the incline, and by the greater leverage thus obtained it carries the wheel nearer to the wind, and thus lessens the speed; but when a lighter wind is blowing the carriage descends the incline, lessening the leverage and permitting the wheel to come around in opposition to the wind.

An improvement in parallel vises, patented by Mr. Niels P. Ringstad, of Mankato, Minn., consists in connecting the jaws with links pivoted to a central slotted guide, in which a traveler is held and pivoted to one pair of the links, whereby, when the jaws are screwed open or shut, the links, turning on their pivots, compel the moving jaw to move in a line parallel to the stationary jaw.

Mr. Alexander McRonald, of Toronto, Ontario, Canada, has patented an improved brake for children's carriages, which is simple, readily applied, and capable of holding the carriages securely, preventing them from moving when left alone.

An improvement in that class of water elevators in which a well bucket is attached to a rope or chain plying over a windlass provided with a crank for rotating it, has been patented by Mr. James C. Barrett, of Marion, N. Y. This is an improvement upon that for which the same inventor received Letters Patent of the United States No. 41,410.

Mr. Fredrick Stedman, McBride's, Mich., has patented improved journal boxes for the machine known as "Hall's shingle machine," which is so constructed as to allow the shafts to play freely as the gear wheels are thrown out of and into gear, and which may be adjusted vertically and horizontally, as may be desired.

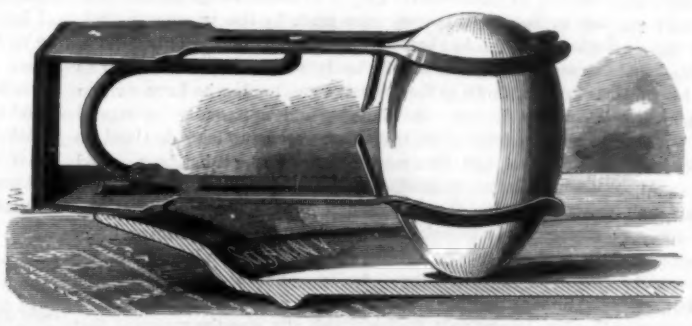
An improved machine for forming carriage shackles has been patented by Mr. Stratten M. Rowell, of Port Chester, N. Y. The invention consists in the construction of peculiar bending dies, which cannot be described without engravings.

An improved pole for telegraph wires, flag staffs, lamp posts, clothes line supports, etc., has been patented by Mr. David Lathrop, of Hazle Dell, Ill. . It consists in the pole formed of three sections sliding or telescoping into each other.

Mr. Andrew Elvin, of Paterson, N. J., has patented a steam boiler which is so constructed that they may be easily, conveniently, and cheaply built, and easily, conveniently, and cheaply repaired. It consists in a steam boiler with a flue extending through it and filled with vertical tubes, and provided with braces or partitions, the whole detachably secured into an outside shell.

NEW EGG HOLDER.

The egg holder represented in the accompanying engraving is the invention of Mr. John S. Birch, of Orange, N. J. It consists of a spring tongs having branched and bow-shaped prongs adapted to clutch the sides or ends of the egg. It is designed more particularly for use at the table, and is better adapted than the ordinary cup to hold the egg on the plate. The prongs are provided with guards to compel the egg to assume the right position, and there is an egg shell discharging device consisting of a curved wire hinged to the lower jaw of the tongs and capable of sliding in a slot in the upper jaw. By pulling this wire the jaws are separated, allowing the shell to fall out.



NOVEL EGG HOLDER.

King Cotton.

The stern-wheel iron steamer Charles P. Choteau recently landed at New Orleans the largest cargo of cotton ever carried by one vessel on the Mississippi, and probably in the world. It consisted of 8,841 bales, the huge mass, piled tier above tier, almost hiding the steamer from view.

New Mode of Exciting an Induction Coil.

Mr. W Spottiswoode, LL.D., finds it a good plan to use the alternating currents of a De Meritens magneto-electric machine to excite an induction coil. In this arrangement the "make" and "break" currents in the primary are alternately in one direction and the other, hence the secondary discharge appears to be the same at both terminals. The advantages of the method are: First, the fact that as the machine effects its own make and break, both the contact breaker and the condenser of the induction coil can be dispensed with; secondly, that the breaking of the primary, and consequently the delivery of the secondary currents is perfectly regular; thirdly, that the quantity of the currents in the secondary is very great. With a 20 inch coil by Apps a spark about 7 inches in length, of the full thickness of an ordinary cedar pencil, has been obtained. But for a spark of thickness comparable at least with this and of 2 inches length, an ordinary 4 inch coil is sufficient. In vacuum tubes under this discharge the striæ are perfectly steady, as with a battery (Gassiot's or De la Rue's), and their brilliancy and configuration can be controlled by means of a shunt in the secondary circuit, formed by a column of glycerine and water, so as to diminish at will the amount of current flowing into the tube.

A Mine of Palm Oil.

According to the *Colonies and India*, that portion of the west coast of Africa which lies south of the River Volta furnishes the principal supplies of palm oil. Nearly 1,000,000 cwt. of this oil are annually exported to Great Britain, of the value of $7,500,000, its principal use being in the manufacture of soaps, perfumery, candles, and similar articles. Among the natives it is highly valued, both for food (taking the place of butter), for lighting and cooking purposes, and for anointing the head and body. The so called oil, which is rather a fatty substance, resembling butter in appearance, is obtained from the fruit of several species of palms, but especially from the one known botanically as *Elais guineensis*, which grows in abundance on the western coast of Africa, and from which it takes its specific name.

So thickly do these trees grow, and so regular and rapid are their supplies of fruit, that in some localities where the regular collection of the produce is not practiced, the ground becomes covered with a thick deposit of the oily, fatty matter produced by the ripe berries. Deposits of palm oil, which may almost be called "mines" of vegetable fat, exist in some parts of the Gold Coast, and which, if not in themselves worth working, at least practically illustrate the natural wealth of the country in such productions, and indicate its undeveloped resources. These "mines" would probably not repay the cost of exploration, as the palm oil is apt to become rancid and valueless for its general uses after long exposure, though for such purposes as candle making these deposits might still be valuable.

THE GILA MONSTER.

This reptile, which Professor Cope calls *Heloderma suspectum*, and to which the specific name *horridum* has also been given, is not uncommon in Utah, New Mexico, and Arizona. It is believed to be very poisonous, but such is not the case. It will bite fiercely when irritated, but the wound is neither painful nor dangerous. The Mexicans assert that its breath is fatal, probably because of its habit of blowing when disturbed.

In the "Zoology of the Survey of the 100th Meridian" it is stated that several specimens were secured in 1881, 1873, and 1874; but with one exception all were lost in transit to Washington. The specimen from which the accompanying drawing was made was kindly forwarded to us by Mr. T. W. Parker, of Phœnix, Arizona Territory, who writes that it inhabits all the mountainous regions along the Pacific coast as far east as the dividing ridge. Very little is known of its habits, except by the natives, who regard it as the most terrible of reptiles, not excepting the rattlesnake.

The Gila monster grows to the length of three and a half feet. Its food is such small reptiles, mice, crickets and other insects that it can easily capture. It is sluggish in movement, traveling no faster than the tortoise. When disturbed it stands as erect as possible and blows at its antagonist, sending forth a stream resembling fog, and believed by the natives and Mexicans to cause instant death. The first Gila monster Mr. Parker ever saw was on Salt River, ten miles from Phœnix. It was about 14 inches long, and was in combat with a snake 4 feet in length. The snake coiled in the usual manner, and as the monster advanced struck his blow firmly, producing no effect upon the tough scaled skin of his foe. The monster then rushed upon the snake, and seizing it with its arms and legs gave two or three bites, then let the snake go. The latter crawled away slowly, seeming to be badly hurt. The monster also took refuge in the brush. Evidently the monster's breath does not paralyze snakes. However, from what he has seen Mr. Parker is inclined to believe that there is truth in the stories the natives tell.

A saloon-keeper of his aquaintance captured a monster alive, and kept it for the amusement of his customers. It was tied in a corner, and as the floor was of earth, as in all houses in those parts, the reptile burrowed a considerable hole as a hiding place. One day—Mr. Parker does not say that he witnessed the affair—a mouse ventured near the hole; the monster sent forth a stream of poisoned breath, and the mouse fell paralyzed. The monster then seized and devoured it. One cannot but wonder that with so favorable an opportunity no one had the wit to test the truth of the popular belief as to the poisonous character of the monster's breath by submitting to it a variety of small animals.

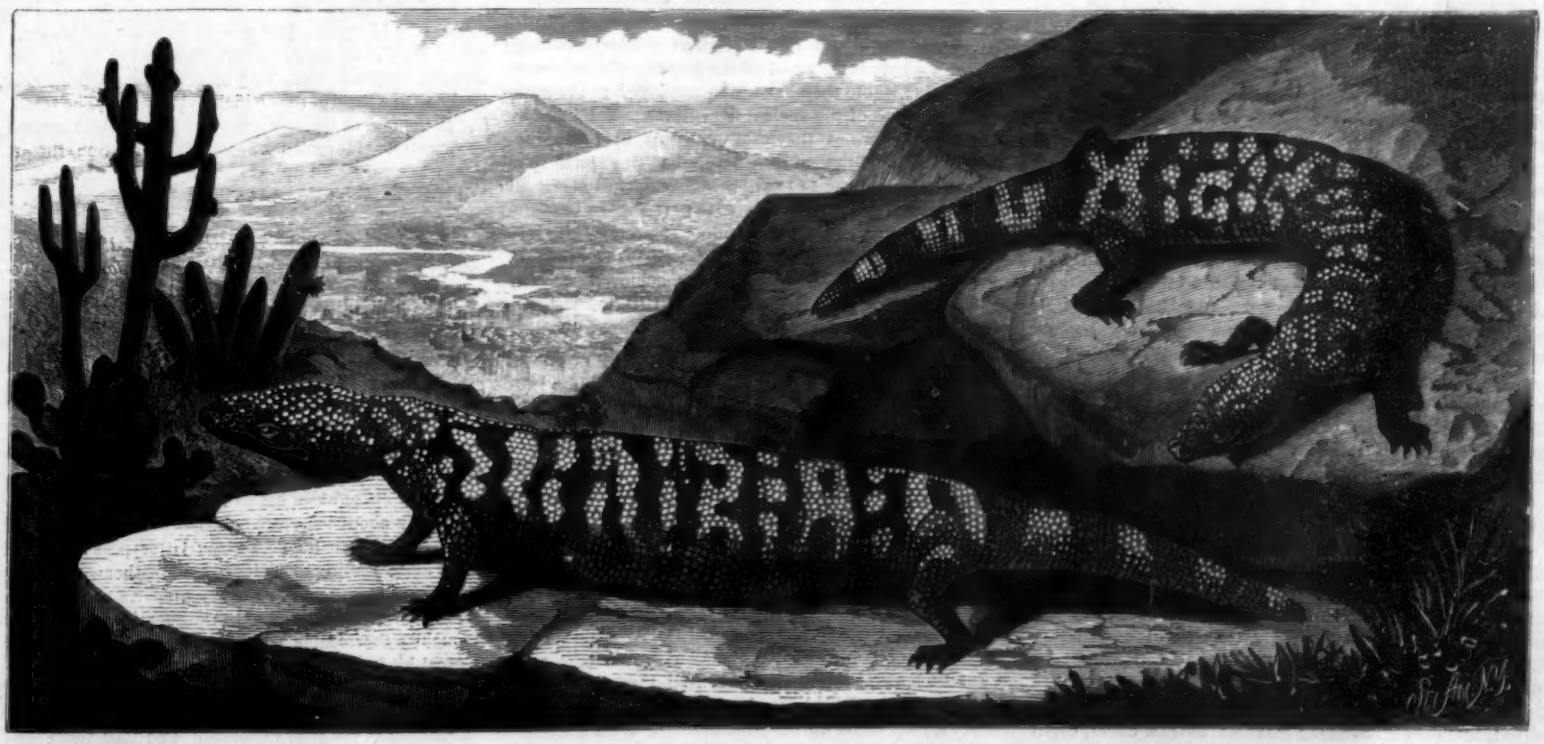
Mr. Parker does not think the monster able to defend itself with its teeth, the latter being so small. Yet he says that he is credibly informed that a man in Arizona, who was bitten while tantalizing a monster, has been paralyzed on that side ever since. It is certain that the Mexicans and natives of those parts regard the reptile with the liveliest apprehension.

Names of Wood Manufactures Wanted.

Mr. Charles S. Sargent, special agent of the tenth census, to whom has been committed the collection of statistics of forest wealth and products for the coming census, wishes information with regard to uses of unsawn lumber. All lumber which passes through sawmills can be readily reached by the ordinary enumerators. What Mr. Sargent wishes to get track of is the considerable applications of wood in manufacture, where small timber or unsawn wood is employed. Any one who can furnish him lists of such uses may materially aid in increasing the scope and value of this portion of the census statistics. Mr. Sargent's post office address is Brookline, Mass.

Cotton by White Labor.

It used to be said that white men could never take the place of the blacks in our Southern cotton fields. Experience has shown the assertion to have no foundation in fact. Inquiries made during the past season by several Southern members of Congress develop the fact that a large portion of the last crop was raised by white men by their own labor. Mr. Manning, of Mississippi, says that the facts he has collected justify the opinion that three-fifths of the crop of 1879 was produced by free white labor.



GILA MONSTER.—(*Heloderma Suspectum.*)

cal reciprocating slide bar carrying a needle

TYING-IN MACHINE.

scribed without engravings.

Preparation of Castor Oil.

BY ERNEST P. HAAB, PH.G.

Castor oil is obtained in the United States by the following method, as witnessed at the "Belleville Oil Works," owned by Messrs. Brosius & Son. The seeds having been thoroughly cleansed from the dust and particles of the pod, with which they are more or less contaminated, are placed in an iron reservoir and slightly heated. Great care is taken to prevent them from being scorched, the object being only to make the oil more fluid for expression. The pressing is now proceeded with by means of hydraulic presses, which are preferred on account of the great force exerted by them. Each piece has a series of movable plates and cylinders, of which each cylinder is filled, the plate pushed in, and then the power applied. The first quality oil is thus expressed, and runs into a large tank below. The pressed seeds are now heaped into a pile and allowed to remain for a day. Next day they are again heated in another iron reservoir, put into a series of cylinders, power is applied, and the second quality, or lubricating oil, is obtained. Messrs. Brosius & Son use a portion of their oil cake for fuel, and send the remainder to the East, where it is utilized in combination with other matter to produce artificial guano. A Philadelphia firm, Messrs. Baeder, Adamson & Co., have resorted to bisulphide of carbon as a solvent for the press cake, thereby obtaining a dark thick liquid. The process is similar to that carried on in France with alcohol, the product, however, being a very common lubricating oil, but without smell of bisulphide of carbon. The firm does not now manufacture any more.

The oil made by the process in use at the Belleville Oil Works is called cold pressed, to distinguish it from any of the other methods in which more heat is employed. The cold pressed oil without doubt deserves the preference, and is now extensively used. The yield per bushel after two expressions is sixteen pounds, or two gallons; the first expression yielding twelve pounds, the second four pounds. Sometimes a third expression is resorted to, but this oil is much colored, and the yield so very small that it hardly pays for the labor and expense incurred; the yield is from one to three pounds.

The process of purifying and clarifying the oil is accomplished in various ways, and is the specialty of every factory. The great point in purification as well as clarification to be noticed is the fact not to expose the oil too long to the air, as it is then liable to become rancid. The first expressed oil is clear white, or rather colorless, like water; the color of the second expression is yellowish, like sirup of squills. Castor oil is remarkable for its power of mixing, in all proportions, with glacial acetic acid and with absolute alcohol without the aid of any other agent. It is soluble in four parts of alcohol, 0·835 or 0·850, at 15° C., and mixes without turbidity with an equal weight of the same solvent at 25° C. Its specific gravity is 0·97 to 0·98; it congeals —at 12° to —13° C., and becomes solid at—40° C.

The oil of the first expression is used for medicinal purposes; that of the second for oiling leather, lubricating machinery, burning, and various other purposes.

The oil cake is either, by the addition of animal matter and other ingredients, made into manure, artificial guano, or is used for fuel. The latter is the customary practice in large oil mills, where a saving of from 40 to 50 dollars a week is effected thereby.—*American Journal of Pharmacy.*

Gum Copal.—A New Theory Concerning the Supposed Sand Marks.

At a recent meeting of the Society of Natural History at Portland, Me., the President, Dr. William Wood, made a verbal communication of much interest in relation to the resin commonly known as gum copal. We copy from the report of the Portland *Advertiser:*

Dr. Wood stated that M. C. Cooke, of London, had made the only approach to a scientific arrangement of the gums and resins that he had been able to find. He has made four principal groups—gums, gum resins, resins, and oleo-resins. The gums, like the arabic and cherry kind, are more or less completely soluble in water. The gum resins are partially so, but the true resins are insoluble in water to any degree, and the hard resins, like some of the copals, are absolutely insoluble in oils or alcohol without some previous method of preparation, while others are capable of being suspended in volatile oils, and are classed as oleo-resins.

Resins are derived from the vegetable kingdom, and nearly all plants produce them in a greater or less degree. But the trees which produce them in sufficient quantities to be of commercial value are to be found principally in South America, the East Indies, and Africa. These belong principally to the natural families of *Dipteraceæ*, or wing fruited trees, only found in India and the islands of the Indian archipelago, and the *Leguminosæ*, or trees which bear pods, like the locust and acacia trees. Of these the Hymenæa seems to be the tree from which the resins most nearly akin to the true hard or fossil copal are mostly derived, though the Vateria and some others have been regarded by many as the sources of the copal resin known in England as anime. But in a note to the *Gardener's Chronicle* (1865) the conclusion seems to be reached after careful comparison with specimens in the Kew Herbarium, that they are derived from *Hymenæa mossambicensis.* From these trees and many others a great variety of copaline gum resins are derived, and are known in the markets as raw copal, copal *vert* in the French market, "tree copal" or *chakazi*, corrupted by the Zanzibar merchants to "jackass" copal.

But the true or ripe copal, properly called *sandarusi*, is the produce of vast extinct forests, and furnishes at the present day the only yet very conclusive evidence of their former existence. It is found buried at depths varying from a few inches to two or more feet, over immense tracts of sandy deserts in Africa, where now no traces of vegetable life exist, except such as, in small masses, are occasionally found under the sands, still clinging to the gum, but so frail as to crumble away at the touch. The resins derived from this source are found to be fretted all over, and that, too, very equally in every angle, indentation, and curve of the surface, with little elevations and depressions of nearly uniform size and character, to which the technical name of "goose skin" has been given. This peculiarity distinguishes the true ripe copal, or "fossil" copal, from all other kinds; and as it is the most valuable, the natives resort to many devices for making the *chakazi* sell for the true copal. The general opinion in regard to the origin of these indentations upon the surface is, that they were made by the impress of sand, when the gum in a soft state was buried in it. This opinion seems to have been a sufficiently satisfactory one, so far as is known, down to the present time, to all who have written upon this subject. So plausible and apparently so natural was this explanation, that no one seems to have doubted its correctness, and, like many another error, it has been passed down from one to another unquestioned.

It was with the design of calling the attention of the society to the question of the origin of the markings upon its surface, that the subject of copal has been introduced for discussion this evening. An examination of some very fine specimens that have been recently presented to the society by Mr. Augustus P. Fuller of this city, was the means of first raising a doubt in the minds of some of us as to the correctness of the established sand theory. It did not seem to bear the test of criticism. Here were masses of very different forms and sizes, some round, others angular, even triangular, with curved faces and jutting points with thin edges; yet all were equally embossed and indented at every point of their surface, even to the thin edges and extremities of the angular ones, and upon every portion of the surface of the rounded ones. It would be difficult to explain how such finished masses could be formed by the ordinary exudation from a standing tree of a liquid mass into the sand. The theory is that the vast areas now occupied by sandy deserts were at some former period, in their whole extent, covered by mighty forests, when the trees must have stood in deep and more or less fertile soil. But even taking it for granted that these exudations were poured out upon the sand, the first layer that reached it would become covered by it, and the next layer would cover this and in its turn be covered by sand, so that the sand itself would have been confined in its interior, very much as the insects which are occasionally found entombed in its transparent walls. But no such occurrence is known. No particles of sand are found in the interior of these masses of resin; or if at all, they are probably even more rare than the insects. This method of pouring out the more or less fluid resin upon the sand cannot be made to fulfill the requirement of indentations made upon the surface only

But suppose that this resin is poured into cavities within the tree itself, made in the progress of natural decay or by the inroads of wood ants or other insects. We shall have all the conditions by which to explain the peculiarities in forms of these masses of resin, the indentations upon every particular part of their surface, and the entire absence of sand from their internal structure. These resins in their nature are imperishable by the lapse of ages and by the causes that have removed from the surface of the earth all traces of the soil and trees that produced them. Buried in the sands that, in the gradual process of change from forest to desert, have swept over these vast areas, they furnish to-day the only evidence of the former existence of such forests. We have some proof of the imperishable character of these resins where they have been employed in the mummifying processes of the ancient Egyptians. Yet these are probably as modern as they are imperfect in comparison with the mummied insects that nature has preserved in all their perfection and beauty in these wonderfully transparent and highly burnished walls of the copal. In regard to the age of copal no entirely satisfactory answer can be given. Professor Gunning has well said "that the revolutions of nature from forest to desert are never achieved in a day, and that the fly or moth which looks as if it had just lit in its crystal coffin, may have been there a hundred thousand years. We are sure that it was there, just as you see it to-day, long before there was any man on earth." The insects found in the copal are said to be those of living species, while those found in amber are of extinct species, and it is claimed that this becomes one of the tests by which gum copal is prevented from being passed off as amber. If this be so it becomes a difficult task indeed to measure the immense antiquity of the amber in such common use at the present day.

The microscope has furnished an important aid in support of the theory of the formation of these copaline masses in cavities of the trees. Coniferous trees, such as the pines, firs, etc., have a peculiarity of structure by which microscopists can determine their presence with certainty whenever and wherever this structure is found, whether in peat, lignite coals, or silicified wood. The woody tissue of these trees is wholly made up of little tubes or cells pointed at at both ends, having upon the surface of each tube one or more rows of circular gland-like disks, each disk having apparently a smaller opening in the center, looking like a ring within a ring. As the pointed extremity of one tube overlaps that of another, the tubes have the appearance of being continuous and of being placed between parallel lines. The impression of just such a structure is easy to be observed upon the surface of the copal, and it is difficult to understand how these impressions could have been made in any other way than by the resin in a liquid state being poured into cavities within the trees. The walls of these cavities in some instances were probably in a state of partial decay and allowed the resin to well penetrate its tissues. There it would harden, and in process of time, when the trees crumbled to dust, would become loosened and ultimately buried in the sands that took the place of or covered up the former soil. These impressions indicate that these trees were almost certainly of the cone-bearing family, and this may in part explain the difference in solubility of the fossil copal and all the species of the *chakazi.*

I have examined several pieces of amber kindly loaned to me by Mr. Kirsch, of this city, in their natural condition, or rather, as they were received by him for the purpose of manufacture. But if this "goose skin" was ever to be found upon them, it has been roughly removed in their preparation for the market, which is, probably, in no way made better by its preservation, as it is in the case of the copals. The surface, however, still appears to bear the impression of cellular tissue.

Chest Development and Consumption.

It is stated "that during the last twenty-five years not a single singer has died of consumption at St. Petersburg, although this disease has outstripped all others and now holds the first place among the causes of death in the Russian capital." From this and other facts Dr. Vasilieff draws an inference in favor of the exercise involved in singing, as a preventive measure against consumption. There would seem to be room for question as to the relation of cause and effect. It may either happen that singers are not consumptive because they can use their chest and throat freely, or that consumptive persons are not singers because the weakness which precedes disease incapacitates the chest and throat for exertion. Both of these hypotheses are true up to a certain point, but neither holds good in all cases. A very little observation will suffice to show that a good singing voice may coexist with a weak or diseased chest, whereas the perfectly healthy may be unable to sing.

It was some forty years ago a common practice to give consumptive patients a specially arranged tube to breathe through with the view of exercising the chest. We venture to hope the experiment will not be repeated. Chest development can only be accomplished in a manner consistent with health during the growing stage of childhood, and then the most natural and convenient methods of exercise are the best. Later on in life great mischief may be done by unduly straining the muscles of the thorax and those of the throat, besides the peril of injuring the smaller tubes and air vessels of the lung by violent exertion, for which the organs of respiration and voice are not adapted because they have not been early trained.—*Lancet.*

Counterfeit Eggs.

It is well known that in America everything is counterfeited; the wooden hams and nutmegs sent from the New England States are well remembered. Eggs are now also counterfeited, and this manufactory is carried out on a large scale. On one side of a large room the reporter saw several large copper vessels filled with a thick glutinous yellow mass, which a man was constantly stirring. This was the yellow of the egg—the yolk On the opposite side were similar vessels, in which the white was fabricated. The egg shells were made of a white substance resembling plaster of Paris, by means of a blowpipe, just as soap bubbles are blown. After being dried in an oven, the egg shells were filled: first with artificial albumen, then with some of the artificial yolk, and lastly with a little of the artificial albumen. The small opening at the end of the egg was closed with white cement; and the greatest achievement of modern civilization, the artificial egg, was ready. In appearance it resembled a natural egg; but, whether cooked or raw, it was indigestible and injurious to health.

[The above we find in the *Canada Medical and Surgical Journal*, credited to the *British Medical Journal.* To make his story complete the writer should have added that at this same manufactory he also saw a number of patent incubators employed in hatching out chickens from these artificial eggs, which was causing great excitement among the farmers and poultry raisers.—EDS.]

Leather from Bison Hides.

The *Western Shoe and Leather Review* remarks that leather from bison hides will soon cease to be a factor in the leather market. These hides began to be sent East in considerable quantities about ten years ago, but did not at first find favor with the tanners here. In the latter part of 1878 two or three large tanning firms took hold of them, and by careful attention in saving and properly preparing the hair and glue stock for market, as well as in the proper tanning of the hide to make a serviceable article of cheap sole leather, they made a great hit in this specialty.

It is estimated that for the past five years about 350,000 bison hides have been taken off annually; now, however, the supply is virtually exhausted, and East India and common hides must be depended upon for future supplies of cheap sole leather.

Calico Printing.

[Abstract of a paper recently read before the Roundabout Club, a literary society, of Melrose, Mass., by L. Williams.]

The lecturer remarked, in commencing, that if Cotton is King, Calico must be *Prints*. Like charity it covers a multitude of sins, and many a man has experienced the dangers that lurk in calico, so that only a veteran should approach it No material for garments was ever so universally worn except one, and that years ago, in a far off land, where the whole female population wore fig leaves. Calico is derived from Calicut, a town in India where the cotton cloth was first made, and strictly speaking is plain cotton cloth, after being figured it becomes prints. The most common cloth now used for printing is known as 64 square 7 yards, meaning a square inch of the cloth counts 64 threads each in the warp and filling, and 7 yards weigh a pound. Immense quantities of this cloth are used annually by the calico printers In the city of Fall River alone there are thirty printeries, and their weekly product is 149,000 pieces, and their monthly pay roll amounts to $310,000; and besides these mills there are hundreds of thousands of yards made in Lowell, Manchester, and other large cities. There are cheaper prints, but the demand at present is for higher grades than the average, which shall weigh 6 yards to the pound and count from 72 to 100 square. Printed calico was probably known to the Egyptians several thousand years ago In India, the printing of calico was originally the well known Randanna pattern, and printed on silk as well as cotton. The manner of making the little squares and other figures seen upon these goods was very primitive, and consisted of tying bits of cord around small portions of the cloth before it was put into the dye pot. Then the yellow or red dye would color the cloth except where it was tied by these cords, these latter spaces being left irregular and white. This was followed by a certain paste or wax laid upon the cloth, which would resist the dyestuff, thus saving the spot beneath so that the wax being removed the white figure would remain. The next idea was to prepare plates of lead, through which were cut the required figures. One of these was laid at the bottom of a large number of these layers of dyed calico, and the other on top, the figures being exactly opposite each other. A powerful pressure was then applied, and an acid, strong enough to take out the color without injuring the fabric, was poured in at the top upon these figures, slowly penetrating the mass and being kept in by the pressure, and thus forming the figure. The next advance was to block printing, the pattern being engraved on blocks of wood, smeared with the color, and stamped on the calico. A greater variety of figures and colors were produced by these, but only by using separate blocks for each color, and also one for the ground and another for the dark line always observable between every figure.

By the "Toby Tub," next invented, all the colors were stamped with only one block, and on the edges of these were pins, which pricked the cloth exactly where to place the next block in stamping, which was done by boys seated at long rows of tables, each with block and color. The calico was stretched between the feet of the boy from one end of the room to the other, and as it was pulled slowly along, each boy would stamp his pattern.

The printing of calico was introduced into England in the seventeenth century, but little progress was made until 1764, when Robert Peel, grandfather of the future prime minister, left the plow for the printery. The block he used, however, had a handle on the back, struck by a mallet to produce an impression. A piece of calico of 28 yards required 448 applications of the block. Copper plates, working much like an old-fashioned press, came next, and in 1785 the cylinder press was invented, and one of the old style was shown by the speaker and described, who said the calico printing press of to-day is the same thing, and the 28 yards of cloth can now be printed in two minutes. The expense of engraving the copper rollers of the cylinder was very great, and they soon wore out. About this time Jacob Perkins, of Newburyport, born there 1766, and who also invented *steel* plates for bank notes, brought out a process of transferring the engraving from a small three inch long steel cylinder to the large copper roller, by first cutting on the soft steel, hardening it, and then bringing it out in relief on a second cylinder, from which, after again hardening, it is pressed on the copper roller, which, when worn out, can easily be renewed.

The partograph is another method of engraving, and the operator sits at a table with the print design before her (for a partographist is generally a very skillful young lady), marked out on a zinc plate nine times the size required. Above the table and in front is the copper roll to be engraved, covered with wax. The operator applies the point of the partograph to the zinc, and immediately a set of pointers attached to the one she is using, by machinery, scratches the same figure through the wax on to the copper roller above. This roller is then immersed in a bath of nitric acid, which eats into the copper where the lines are traced, and thus engraved. The design is made nine times its size by being placed in a camera, and afterward rubbed into the zinc, making it more distinct to the designer.

Let us follow a piece of calico from its unbleached state to a finished condition. First, it is bleached to make it white, then it is singed by placing over gas jets or red hot plates to remove the nap or fuzz, and it is then ready for the printing machine, which weighs 10 tons, is 10 feet high, and will print from 1 to 12 colors at once. The figure is engraved on copper rollers, each having a separate roller, which revolves in a trough of coloring matter, covering the roller completely, but a parallel flat rod called the 'doctor," the exact length of the roller, scrapes from it all the color except in the engraved lines, and as the cloth is pressed against the roller, the figure is stamped, each roller imparting one color only, and each exactly fitting the other. Colors and their formation of various chemicals were very fully described by the lecturer, who stated that within eighteen months a great revolution has taken place in the printing of calicoes, and that certain colors, like green, blue, and yellow, once hard to produce, can now be brought out at will, and madder, once so important, is now a thing of the past, and superseded by steam colors and chrome, which last fixes the color. Finishing, folding, labeling, and packing into cases complete the task of printing.

Each case contains 2,000 yards, or enough to clothe 200 women. There are 330 printing machines in the country, with a capacity of printing 1,500 pieces each, or a total of 525,000 per week, each piece containing 40 yards, or 21,000,000 yards, and the United States stands second in the business, the printeries of England placing her number one, one printery alone near Manchester running 52 machines; and in France, also, are many manufactories. Mr. Williams said that twenty years ago not a jobbing house in Boston but had a line of English goods, but to-day, and for some time past, it would be difficult to find any; our best designers, however, are from the mother country, and those printers are most successful which employ best designers and printers.

In the Centennial year numerous curious and patriotic designs were made, and a very rare bed quilt made from these was exhibited, the lecturer declining to mention the number of pieces in it, remembering the old proverb, "As you make your bed quilt so will you *lie*." He first suggested a design for patchwork calico, thus saving the time of old ladies, who formerly spent it in making patchwork quilts; and one of these patchwork designs has been produced more than any other engraved in this country. There was a fierce struggle against the introduction of calico by manufacturers of linens and woolens in England and France, and laws were enacted forbidding its manufacture and also its sale, until Madame Pompadour first procured its use in France for furniture covering. It first made its appearance in America in 1788, in the State of Rhode Island, but strenuous opposition was made by the English to have either machinery or printers brought over the water. The lecture closed with some humorous stories concerning calico, and good advice was given to young men about choosing a wife who always displayed neatness and good taste in her morning calico.

A collection of designs of various styles and of the machinery and apparatus used in producing these prints, was used in connection with the lecture, and aided in making it one of the most interesting and instructive ever given in the town, and one much appreciated by the audience.—*Boston Journal.*

Timbuctoo.

The following information with regard to the little-known city of Timbuctoo was lately obtained by the Geographical Society of Oran, Algeria, from an Israelite Rabbi of Morocco, who was on his way from Timbuctoo to Paris. The Rabbi described Timbuctoo as an Arab town in every sense of the term, built absolutely like all those of the interior. The inhabitants are Foulah negroes, and there are no whites. There are, however, sometimes Jews from North Africa, who come to trade, but they never settle there. The town is at about an hour's distance to the north of the Niger. Its population is about 50,000; it is larger than Oran (about six miles round), but not so large as Marseilles. The town is, in fact, a mass of villages, extending over a very considerable area. The Niger, which passes to the south of the town, flows from the west to the southeast, and is very broad; there is abundance of fish. Navigation is carried on by means of oared barges and rafts, constructed of pieces of wood bound together by cords. The blacks call the Niger the Nile, or "El Bar" (Arab, "the sea"). The river is subject to regular floodings, which fertilize the lands on its banks, the only ones which are cultivable; the inundation reaches the walls of the town. The country is very fertile; the crops are sorgho, millet, rice, tomato, onions, turnips; indigo grows wild. There are also many cocoanut trees, gum trees, and a tree which produces oil which the natives use for lighting. There are also forests of valuable timber trees. The country is governed by a Marabout, who takes the title of Sultan; the present ruler is named Mohamet-el-Bekai. He does not reside at Timbuctoo; his capital is Ahmet-Ellah, a town of more than 100,000 souls, situated about twelve leagues from Timbuctoo. The road connecting the two towns is covered with villages and gardens. The town of Timbuctoo is under the command of a Caid, who has very great authority, and who has under his orders a tax collector, also very powerful. The Sultan has no army, but when fighting is necessary everybody is a soldier They are armed with bows and arrows; only the chiefs have guns, pistols, and sabres. Trade is carried on principally by barter or by means of cowries. Caravans bring cotton or linen goods, glass trinkets, mirrors, arms, swords, guns, pistols (generally of English manufacture), knives, needles, etc. Salt is a valuable import, a slave often being given for a kilogramme or two. The caravans take back loads of the grain of the country—rice, sorgho, millet, ostrich feathers, gum, ivory, gold dust, lead, copper, etc. Trade in slaves is carried on on a very large scale. To the north of Timbuctoo many camels are reared; to the south the people wander about with herds of sheep and cattle.

ENGINEERING INVENTIONS.

An improved engine governor and speed regulator has been patented by Mr. Joseph Reid, of Monroe, La. This invention relates to a governor based upon the principles of gyroscopic action. A reliable automatic stop device is provided, which, being a portion of the governor that is regularly in use, is not liable to become gummed or stopped, but is always in working order.

An improvement in rock boring machines, patented by Mr. William W. Graham, of West Rutland, Vt., relates to adjustable brackets, gauges, and guides for what are known as "diamond rock boring machines," the object being to provide means for boring the alternate holes of a series the proper distance apart, at whatever angle they may enter the rock surface; also to provide means for preventing the boring hub and spindle from running to the right or left of the line, thereby insuring an open communication between the holes bored by the first and second operations.

An improvement in bridges has been patented by Mr. Robert B. Vardell, of Dardanelle, Ark. The object of this invention is to provide a bridge of great strength and durability, that can be thrown across a stream at a single span, and require for its support only an abutment at each end.

Mr. Michael F. Craig, of Nevada City, Cal., has patented a device which consists in the combination, with a locomotive, of apparatus for sprinkling or wetting the rails either in front or behind the driving wheels, as circumstances may require, the apparatus being under control of the driver.

An improved rotary engine has been patented by Mr. George Murray, Jr., of Cambridgeport, Mass. The object of this invention is to provide a novel and simple device that can be used as a steam or hydraulic engine to transmit power, or as a force pump or blower when power is applied to it. It consists, essentially, of a universal joint with solid sections fitted snugly, but so as to revolve within a globular shell.

Mr. John C. Dean, of Indianapolis, Ind., has patented an improvement in valve gears, which consists of an arrangement in the steam chest of a direct-acting steam pump, of an auxiliary piston and valve, that are so operated as to regulate the admission and exhaust of steam to and from the main steam cylinder, and prevent loss of steam when the pump is in operation.

An improvement in spark arresters for locomotives, patented by Mr. David Hawksworth, of Plattsmouth, Neb., consists in a cup-shaped spark arrester that deflects the sparks against the sides of the stack. This is combined with a stack having an annular chamber that receives the sparks, from which chamber they are drawn by suction obtained by the use of an interior conical pipe or nozzle, the sparks and cinders being thus circulated and broken up until they pass off in dust.

Mr. Charles Bried, of Newark, N. J., has invented a boiler shell constructed of convexo-concave plates, united together with their convex surfaces inward to form a fluted cylinder, and with their joints stayed against springing by braces applied at the outside of the boiler, whereby the shell is rendered capable of sustaining high pressure at the inner side without spreading or rupturing.

Gloomy Thoughts and Gloomy Weather.

Dull, depressing, dingy days produce dispiriting reflections and gloomy thoughts, and small wonder when we remember that the mind is not only a motive, but a receptive organ, and that all the impressions it receives from without reach it through the media of senses which are directly dependent on the conditions of light and atmosphere for their action, and therefore immediately influenced by the surrounding conditions. It is a common-sense inference that if the impressions from without reach the mind through imperfectly-acting organs of sense, and those impressions are in themselves set in a minor æsthetic key of color, sound, and general qualities, the mind must be what is called "moody." It is not the habit of even sensible people to make sufficient allowance for this *rationale* of dullness and subjective weakness. Some persons are more dependent on external circumstances and conditions for their energy—or the stimulus that converts potential kinetic force—than others; but all feel the influence of the world without, and to this influence the sick and the weak are especially responsive. Hence the varying temperaments of minds changing with the weather, the outlook, and the wind.—*Lancet.*

The Scientific American in Turkey.

The United States Consul General at Constantinople writes to this office, under date of October 31, that he had sent a copy of the SCIENTIFIC AMERICAN to the Palace, and it is, adds the writer, a gratifying evidence of the interest it creates, that the Sultan has ordered portions of it to be translated into Turkish for his reading.

The Origin of Coal.

Various theories have been propounded to account for the origin of the different kinds of mineral fuel which form the basis of modern industry. The most eminent geologists have hitherto ascribed the formation of coal to large quantities of driftwood accumulating in estuaries, where they were subsequently covered by sedimentary deposits, the ligneous structure becoming modified in the course of ages. Mons. E. Frémy has recently published some valuable researches on the origin of coal, in the course of which he arrived at results differing considerably from those obtained by other observers. In examining the various substances which might be supposed to give rise to beds of coal, some interesting observations were made. It was found, for instance, that all wood contains a substance which has been called vasculose, and to which its physical properties are chiefly due. It is present in oakwood to the extent of 30 per cent. In searching for a method to distinguish lignites from genuine coal or anthracite, it was found that the former are completely decomposed by nitric acid, which is not the case with the latter. In the first series of experiments, vegetable tissues, or the skeletons of plants, were heated in closed iron tubes for many hours, at a temperature of from 200° to 300° Centigrade. Steam, acids, gas, and tar were given off, while the vegetable substances, although becoming black and brittle, retained their original shape, and offered no resemblance to coal.

Other substances produced by the vegetable world were then treated under similar conditions. Among those bodies experimented upon were sugar, starch, gums, chlorophyl, and resinous and fatty substances of vegetable origin. By prolonged heat combined with pressure these bodies were converted into substances offering a certain resemblance to coal. They were of a brilliant black, frequently fused, insoluble in neutral acid or alkaline solvents, and, when exposed to a red heat, gave off water, gas, and tar, leaving as residuum a hard and brilliant coke. The chemical analysis of these substances confirmed their resemblance to coal, as may be seen from the following examples:

	Carbon.	Hydrogen.	Oxygen.	Ash.
Coal made from sugar	66·84	4·78	28·48	—
Coal made from starch	68·48	4·68	26·84	—
Coal made from gum arabic	78·78	5·00	16·22	—
Pit coal from Blanzy	76·48	5·23	16·01	2·28

These three substances were chosen for experiment because, being most abundant in the vegetable kingdom, they probably played an important part in the formation of coal. But, although these bodies were so easily converted into coal, it remained to be explained how the tissues of plants could be changed into the same substance. A clew was given by the analysis of pieces of fossil wood, which were found to contain considerable quantities of ulmic acid. This acid exists also in peat, and may be produced from the vasculose contained in wood. In order to ascertain the influence of ulmic acid on the formation of coal, it was exposed to a high temperature in closed vessels. The following analyses show that the percentage of carbon increased with the duration of the experiment:

	Carbon.	Hydrogen.	Oxygen.
Coal made from ulmic acid heated for 24 hours	67·48	5·84	26·68
Coal made from ulmic acid heated for 72 hours	71·72	5·03	23·25
Coal made from ulmic acid heated for 120 hours	76·05	4·90	18·95

Like natural coal, the substance produced was insoluble.

Ulmic acid produced from vasculose was remarkable for its fusibility; this may account for the similar property of bituminous caking coals. On treating leaves with alcohol, various substances, such as chlorophyl, fatty bodies, and resins are extracted. When these were heated together for 150 hours a mass was obtained closely resembling natural bitumen.

The above experiments render it highly probable that the plants which gave rise to coal first underwent a species of peaty fermentation, during which they lost their organic structure. The peat thus formed became gradually converted into coal by the combined action of heat and pressure.

Tobacco, Cotton, Corn, and Wheat.

The estimate of the tobacco and cotton crops of this year, printed in this paper some weeks ago, proves to have been over-hopeful. Instead of exceeding last year's yield they will both probably be short. The report of the Department of Agriculture, issued November 15, gives the following estimates:

Tobacco.—The indicated produce for the entire country is 98 per cent of that of 1878. The gain has been greatest in Tennessee, Connecticut, and New York; the loss greatest in Ohio, Missouri, and West Virginia, with a material decrease, also, in Maryland, Illinois, and Indiana. In general, the quality is better than that of the previous crop, though damage to some extent from "house-burn" is reported from Kentucky and Virginia, and from frost in Ohio.

Cotton.—The returns indicate a yield per acre of 176 pounds lint, against 191 last year. This yield, estimating the area planted at 2 per cent more than last year, would make a deficit in this year's crop of 290,000 bales of 450 pounds each. All the South Atlantic States show some decline. Texas falls off 35 per cent. All the States bordering on the Mississippi River show decided gains.

On the other hand corn and wheat show gains, as follows:

Corn.—According to the returns of November 1 the corn crop promises an increase of 200,000,000 bushels, or nearly 15 per cent over last year. The Atlantic and Gulf coast States note some decrease, but the other portions of the Union have greatly increased their yields. The Southern inland States increased nearly 30 per cent, and the other parts of the Mississippi valley nearly 20. The Pacific States report about the same yield as last year.

Wheat.—The returns of November 1 show an increase in this wheat crop of 26,000,000 bushels over that of last year. This great increase is the result of the very large yield in all the States bordering on the Ohio River and Missouri. The Northwestern States show little variation from last year. Kansas and California both decline in yield. Texas, of all the Southern States, is the only one that falls off in yield this year.

How Wheat is Raised in Dakota.

Recent investigations as to the methods of cultivating wheat in the northwest, the cost of the crop, and so on, have been made by a special commission appointed by the British Government. In the course of their observations and inquiries the following information was obtained at the Dalrymple farm:

So soon as the frost has left the first six inches of soil, which is generally by April 1, the seeding of the wheat commences. Scotch Fife, a good, hard, thin skinned red variety, is used. The seed is selected for the newly broken up land. If any cockle or other weeds are observable, they are carefully winnowed out. No dressing or pickling is adopted. During autumn or winter, in 1 5-8 bushel lots, the seed for each acre is bagged up. Whenever the weather permits seeding commences. The seed is distributed by broadcast machines, one hundred being at work daily for three weeks. Two hundred sets of harrows complete the operation, two or three turns being required, and Mr. Dalrymple jocosely states that he orders it "to be well done, and then give one turn more." Four harrows, united by chains, work in a set, cover twenty feet, and are drawn by four mules. In each harrow are seventy-two round teeth. The set costs $14 to $15. Immediately after the wheat seeding, the oats and barley grown for horse provender are put in.

No horse or hand hoeing, no weeding, or any further expenses are incurred until harvest, which begins early in August. About 300 extra men are engaged. One hundred and fifteen automatic self-binding harvesters are busily at work; 100 of these are Walter Woods', the remainder McCormick's. Both are reported to do their work admirably; no objection is found to the wire binding. The grain is shocked, and cutting is overtaken in twelve days. No time or outlay is expended in stacking. The twenty-one steam thrashing machines, made the Buffalo Company, and costing $600, with thrasher, winnower, and straw elevator in one, are placed at convenient points throughout the fields. Ten wagons, each with a pair of horses or mules, bring up the shocks and carry off the thrashed corn in three bushel bags an average distance of two miles to the railway cars. A gang of twenty-five men keep wagons and thrashing machines steadily going, and deliver at the station 1,000 bushels of wheat daily. Each day the thrasher and engine, which is partially self-propelling and costs $800, is moved so as to shorten haulage of sheaves. Every busy day, fifty railway cars, each containing 400 bushels, are loaded, and stand ready for dispatch, usually to Duluth, 254 miles distant, on the western corner of Lake Superior.

The crop of the present year Mr. Dalrymple states to be much the same as that of former seasons. It averages 20 bushels an acre of 60 lb. to the bushel. The natural weight is 59 lb. to the bushel. As usual the produce of the newly broken-up land is best. The quality is fully as good as that of 1878. When run once through the winnower at Duluth, it will be graded No. 1 hard. Mr. Dalrymple usually sells as fast as he can deliver, but this year, holding for the rise, he has still the chief portion of his crop warehoused at Duluth. The oats are reported to yield 50 bushels to the acre, and 38 lb. to the bushel; last year 60 bushels were produced. The barley has not done particularly well this year, but generally runs 40 bushels. On each farm a few potatoes, cabbages, swedes, and other vegetables are grown for home use and for the cows which are kept to supply dairy produce; but wheat growing is the great business of this great farm.

Now comes the important question of the cost of production. Mr. Dalrymple furnishes the following figures: Land valued at $12 per acre, interest thereupon at 6 per cent, 72 cents; taxes and rates, 10 cents; buildings, machinery, and teams valued at $10, interest at 10 per cent, 10 cents; plowing $3; seed, $1.50; harvesting and thrashing, $3; total, $8.42.

Mr. Dalrymple thus produces an acre of wheat for less than $8.50 (34s.) per acre; indeed he asserts that hitherto the actual cost has not reached $8, excepting in the case of the first year's crop, which the extra expense of breaking up and two plowings advanced to $11. For four years his acreable yield has averaged 20 bushels, each of which, on the basis of the above calculation, would cost 42 cents, or 1s. 9d. On his own and other suitable wheat-growing farms, in favorable seasons, Mr. Dalrymple declares that the crop does not cost more than 35 cents per bushel. Sold, as it readily can be at the railway station at Casselton, at 75 cents to 80 cents, a very handsome profit is obtainable.

M. L. Collot has discovered the true *Phylloxera vastatrix* upon *Vitis caribæa*, a wild species of vine found in the forests of Panama, far removed from any vineyards or localities where the true vine (*V. vinifera*) is cultivated. This strongly confirms the opinion that the *phylloxera* is indigenous in America.

The Indians as Farmers.

In his annual report to the Secretary of the Interior, Commissioner Hoyt states that during the past year there has been among many tribes a marked advance toward civilization. The substantial results of Indian farm labor during the year 1879 are given as follows:

By Indians, exclusive of the five civilized tribes of the Indian Territory:

Number acres broken	27,131
Number acres cultivated	157,056
Number bushels wheat raised	328,637
Number bushels corn raised	643,286
Number bushels oats and barley raised	189,054
Number bushels vegetables raised	390,698
Tons hay cut	48,333

By the five civilized tribes:

Number acres cultivated	273,000
Bushels wheat raised	565,400
Bushels corn raised	2,015,000
Bushels oats and barley raised	200,000
Bushels vegetables raised	336,700
Tons hay cut	176,500

The Commissioner says that the only sure way to make Indians advance in civilization, under the best conditions to promote their welfare, is to give each head of a family 160 acres of land, and to each unmarried adult 80 acres, and to issue patents for the same, making the allotments inalienable and free from taxation for twenty-five years; also that from all except the five civilized tribes there has been a call for such allotment of land, and a largely increased desire for houses, agricultural implements, wagons, civilized dress, etc., etc.

The End of a Famous Mill.

English papers announce the total destruction by fire of the famous Heathcoat Mill at Loughborough. The founder, Mr. Heathcoat, in 1809 invented an improved twist lace machine that virtually revolutionized the industry. The introduction of these labor-saving machines led to the Luddite outrages, and in 1816 a gang from Nottingham, armed with pistols, hatchets, and axes, attacked Heathcoat's mill, overpowered the armed watchmen, shot and injured one of them named Asher, destroyed fifty-five costly frames, cut and burnt the lace, and did damage to the amount of more than £10,000. Some accomplices in the outrage gave evidence against their companions, and at Leicester Assizes six men were sentenced to death on a charge of shooting with intent to murder. They were executed at the New Bridewell in Leicester, and it is a noteworthy fact that at those Assizes twenty-three men were condemned to the punishment of death. The six Luddites were hung up with a man whose crime was that of setting fire to a stack of oats. The action of the Luddites drove the manufacture from Loughborough to Tiverton, where Mr. Heathcoat amassed a princely fortune.

The Revival of Trade.

Speaking of the more hopeful condition of British trade the London *Times* traces the improvements to "a genuine growth of the industrial organism of the United States." "The revival of our trade, so far as it is healthy and has promise of permanence, has been due to the recovery of industry in the United States. The self-love of some appears to be wounded by this admission. It makes our economic condition appear to be more dependent on the economic condition of other countries than they like. They may be consoled by the reflection that the interdependence thus revealed is mutual. If the recovery of the United States helps to give life to some of our industries, we by those same industries sustain the recovery in the United States."

Good Tunneling.

The new Almaden quicksilver mines, in Santa Clara County, California, are said to have over 35 miles of workings underground, it being a two days' journey to make a circuit of all the shafts, tunnels, drifts, etc. In the Santa Isabel shaft, after descending 1,700 feet, ventilation became so bad that the work had to be stopped, although the vein at that point was very rich. Another shaft was sunk over a quarter of a mile from the first, but when the same depth was reached, the atmosphere again became insupportable. To meet the difficulty, the engineer, Hennen Jennings, commenced the construction of a drift, to connect the two shafts on the 1,700-foot level, and thus secure ventilation. The excavation was begun simultaneously from each shaft, and the error at the point of connection was, it is said, only 25 thousandths of a foot, while the walls of the drift came together so closely that the point of intersection could not be detected without the use of a transit. When the tunnel was complete, a draught of air rushed through, putting out the lights of the miners, and reducing the temperature to an agreeable coolness. It is doubtful whether closer surveying under equally difficult circumstances has ever been performed.

The Assay of Silks.

The recent spontaneous combustion of grossly adulterated silk brought somewhat prominently into notice the extent to which such adulteration prevails in Europe. The weighting of silks has awakened complaint in another direction, namely, from the silk-growing departments of France, whose industry is ruined by it. Cheap foreign silks serve equally well for loaded tissues, and the market is spoiled for the high class products of France. Accordingly it is proposed to establish at Lyons a central office for the cheap and rapid assay of silks, so that in all sales of silks the value of the goods may be rated by the proportion of silk which they contain.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

NEW BOOKS AND PUBLICATIONS.

RIVER SURFACES. By Henry F. Knapp.

A lecture delivered last April before the polytechnic branch of the American Institute, in opposition to the employment of jetties for the improvement of river mouths, as at the passes of the Mississippi. Mr. Knapp believes that the work done by Captain Eads will be overwhelmingly and permanently disastrous, and asserts that all similar works in Europe have not only been great engineering failures, but terribly injurious in their effects. The pamphlet does not say by whom or where it is published nor where it can be purchased.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. S. M. writes: I have a six inch (21 inch swing) lathe, foot power 3 speeds, 1 inch belt. 1. What size and weight balance wheel do I require? A. From twenty four to twenty-seven inches diameter and eighty to one hundred lb. weight. 2. Which bearings are preferable, friction wheel or wheels, boxes, or points? A. Either good journal boxes or roller bearings will do. 3. What advantages do swivel bearings possess? A. They admit of springing the lathe frame without binding the journals. 4. What is the proper speed for a 1¼ inch circular cutter (1-16 inch thick) for metal? A. It depends on the material being cut. For steel and wrought iron, about two hundred turns per minute; for brass, from four hundred to five hundred turns per minute.

(2) A. W. C. asks for a preparation for coating paper to make it resist the action of acids, alkalies, and water. A. Dissolve caoutchouc cut into small shreds, in a mixture of bisulphide of carbon with sixper cent of absolute alcohol. The solution may be diluted as desired with the mixed solvents.

(3) D. E. writes: I have some silicate of soda that has got so thick that I can hardly get it out of the bottle that it is in. Will you tell me how to soften it, or what solvent to add to it in order to make it thinner? A. Use boiling water.

(4) H. C. T. asks whether there is any difference by using solid piece of charcoal iron well annealed, or is it best to use several wires bunched, for a core of a medical battery in the coil. A. The core formed of a number of wires is best, as it is more readily magnetized and demagnetized.

(5) J. A. H. asks. Does the combination of all colors produce black or white? A. White light is union of all the colors of the spectrum. Black is the absence of color.

(6) W. E. J. writes: My store front contains two plate glasses, measuring five feet by ten feet each, and during cold weather are heavily coated with frost in such quantity that it is impossible to get a view of contents in window. What shall I do to prevent it? A. Some of the storekeepers in this city place a gas pipe provided with a number of burners along the bottom of the window near the glass; a small flame burns from each burner, the heat thus generated prevents the moisture from condensing on the glass.

(7) J. L. asks (1) how to make toy rubber elastic faces, such as are shown by street men, by pressing into all manner of expressions with the finger and thumb. I think gelatine and sugar are used. A. The composition consists of glue, 5 parts; glycerine, 5 parts; zinc white, 2 parts; oxide of iron—rouge—q. s. Soften the glue in cold water, dissolve it in the hot glycerine, and continue the heating over the water bath for several hours, to expel as much of the water as possible; then add the coloring matters reduced to impalpable powders, and cast in warm oiled moulds. 2. We find 1 part of white glue and 4 parts of glycerine make too soft a copying pad. How shall we remedy? A. Heat over a water bath to expel excess of water. See notes on this subject, p. 325, current volume. 3. Your advice to use tungstate of soda in which to dip lamp wick to make it non-combustible does not work. Would silicate of soda answer, or would a mixture of glue and asbestos powder answer? A. If tungstate of soda is properly used, it will answer admirably; silicate of soda will also answer, but not so well. The mixture you suggest would be of little use.

(8) G. A. H. writes: I have been constructing an annular hydro-oxygen blow pipe, and find the effect better when I let the hydrogen come from the inner jet, and the oxygen from the outer one. A. If your blow pipe is properly proportioned you should get the best effect by allowing the hydrogen to escape through the outer orifice, and the oxygen through the central one.

(9) E. S. M. writes: I have been experimenting on lens grinding and polishing, with a convex and concave tool, using the one to keep the figure of the other perfect. After grinding I cost one of the tools with pitch, and shape it by pressing the other on it while still warm, with a piece of paper between them, according to Dick's practical astronomer. I have made my tools ¼ cf the diameter of the lens larger. Now, the center of the lens polishes nicely, gradually growing more dim toward the edge. What is the cause? A. Your difficulty probably arises from your method of grinding and polishing. When the tool in grinding seems to bear hardest and cut most near the edges of the lens, it is necessary to take long, bold circular strokes, with the pressure principally sideways.

(10) W. H. S. asks (1) how to make a good rheostat. I am using a Wallace electric machine, and wish to use nearly all the current at one bath and only a small part at two others. A. A good rheostat for your purpose can be made by winding copper wire in open coils on wooden reels. This arrangement allows the heat to escape readily from the wire. 2. Also how to bronze iron door hatch catches and hinges, by dipping or brushing—something quick and cheap—a brown color that we see on cheap hardware? A. The finish you mention is obtained by dipping the articles in linseed oil and baking them until the required color appears. We do not know of a quicker or cheaper way of doing it.

(11) P. J. H. writes: I have a Bunsen cell with a six quart jar: can I arrange it to give shocks? A. You can give shocks by connecting with your battery an induction coil like that described on page 200, Vol. 39, of SCIENTIFIC AMERICAN.

(12) R. H. B. writes: A dispute arose among certain parties in this city which it was agreed to leave to your paper (SCIENTIFIC AMERICAN) to decide. A argues that on January 1, 1879, the Christian world was eighteen hundred and seventy-nine years old. B that it was only eighteen hundred and seventy-eight. A. Both wrong. The custom of dating from the birth of Christ was introduced about the middle of the 6th century by a Roman abbot named Dionysius Exiguus, who placed the event some four years too late. That would make the "Christian world" actually about eighteen hundred and eighty-two years old at the close of 1878, assuming, of course, that the second year of the "Christian world" began at the close of the first twelve months after the birth of Christ. With the 31st of December, 1878, the 1878th year of the Christian era was completed. The next day and date marked the beginning of 1879.

(13) W. G. H. asks: 1. How many telegraph cables between America and Europe are there at the present time, and what are the termini on this side? A. Anglo-American has two cables in operation from St. Pierre, and one from Heart's Content. The Direct U. S. Cable Company has one cable in operation; lands at Torbay, U. S., and connects by short cable to Rye Beach, N. H. The French cable, which is one of the two landing at St. Pierre, is connected by short cable to Duxbury, Mass. 2. Is there any truth in the statement sometimes made that the rotation of the earth on its axis from west to east, tends to wear the eastern rails of railroads running north and south more than the opposite side? Is such difference in the wear capable of any actual proof by experience of railroad managers? A. It has been asserted by some railroad men that this is the case; we know of no direct experiment or observations to determine the question, nor have we heard any good reason assigned why it should be true.

(14) J. W. S. asks: 1. Could an astronomical eye piece be made of two plano-convex lenses to give a power of 100 times on a telescope having an object glass 3 inches in diameter and a focal length of 48 inches? A. Yes, the magnifying power of the instrument is represented by the ratio of the focal length of the object glass to that of the eye piece; therefore in order to get a power of 100 times with an objective having a focal length of 48 inches, the eye piece should have a focal length of 0·48 inch. 2. If so, of what size and focal lengths should they be? A. The eye lens should be about ⅛ inch in diameter and ¼ inch focus, the field lens ⅝ inch in diameter and 1⅛ in focus. 3. How far apart should they be placed? A. 1 inch—one half the sum of their focal lengths.

(15) E. G. M. writes: I am about to build a road machine on a large scale; it is to be like a three wheel velocipede. The front wheels to be 12 feet in diameter, the rear 4 feet. What kind of motor is light and strong? How would two springs do, each one to work separately while one is running down, the other to be wound up, and so on? A. Springs might probably do, but manual effort is the real power after all, and might be much better applied direct to the work.

(16) W. C. M. writes: 1. Will the induction coil described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, be too strong to use for giving shocks with small battery power? A. Yes. 2. How many small bichromate battery cells will be necessary with the induction coil to give a 1½ inch spark? A. 6 or 8. 3. Could the coil be fixed in any way so as to be used with an electric pen? A. Yes; see experiments with induction coil in SUPPLEMENT 166.

(17) G. G. P. asks: Is there a vacuum in a siphon pipe when the siphon is in operation? A. There is a vacuum more or less perfect produced when the siphon is first started in the usual way, but if as it continues to operate it remains full, there can be no vacuum, as the whole pipe is filled with liquid.

(18) R. C. asks: 1. Why are inches on American carpenters' rulers and yard measures numbered from left to right, while the English are from right to left? A. We do not know that this is the universal practice. 2. Why are the closing exercises of American colleges and academies always called "commencements?" A. Because it is the time when students commence bachelors.

(19) N. P. S. writes: 1. I notice in a late number of the SCIENTIFIC AMERICAN an excellent article on "brass finishing." Now will you please give some instruction how to finish small iron castings, japanning and bronzing, or coppering? A. A good black japan varnish is made by melting together 50 lb. of pure asphaltum, 8 lb. dark gum anime, and 12 gallons of linseed oil. Boil for 3 hours. Melt 10 lb. dark gum amber, boil it with 2 gallons of linseed oil. Add this to the other with a quantity of drier, and boil for two hours longer, or until a little of the mass when cooled may be rolled into pills; then withdraw the heat and thin down with 30 gallons of turpentine. Apply with a brush, and bake the japanned articles in a hot oven. For process of coppering castings, see p. 219, Vol. 40 (43), SCIENTIFIC AMERICAN. 2. In performing the well known experiment of producing a musical note on a glass tumbler, I am unable to understand why in filling the same with water the pitch of the note changes from a high to a low, as the quantity of water increases. A. The water retards the vibration of the walls of the tumbler, and consequently lowers the tone.

(20) S. S. W. asks for a good recipe for polishing wood, such as walnut, cherry, and maple. A. Mix three parts of rather thick alcoholic shellac varnish with one part of boiled linseed oil. Shake well and rub briskly on the wood with a cloth rubber.

(21) J. McG. writes: I have made a copying pad according to the directions given in your last issue, and have been quite successful apparently, as it seems just as good in every respect as those which are being sold in this city at ten dollars. I have, however, not succeeded so well with the ink, for although I have followed your directions, I cannot get more than ten copies with it, and each copy is fainter than the preceding one. The ink seems quite thick, but does not assume that green color which you speak of. Can you give me any further particulars as to making the ink? A. You have probably not selected the proper dye. Use 3 B aniline violet, and do not add an excess of glycerine. From ink prepared according to the formula referred to 170 clear copies have been taken.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. F. McC.—No. 1 contains a small quantity of gold associated with copper pyrites. No. 2. It is a cephalopod (*Orthoceratite multicamerata*) replaced by iron pyrites. The *orthoceratite* had a long straight shell divided into sometimes as many as 70 chambers, formed to accommodate the periodic growth of the animal, which, as it increased in size, moved forward into larger quarters and built a new apartment with wall behind it. Thus, in time, a long series of chambers were made, each larger than its predecessor but all connected by a membranous tube ("siphuncle"). The animal had many muscular arms, with which it seized and entangled its prey. Some of these shells have attained a length of 30 feet and a foot thick. They inhabited the Lower Silurian ocean. No. 3. Portions of a crinoidal column or "stone lily," an order of radiates, of the animal, not vegetable, kingdom. No. 4. It is a magnesium limestone (dolomite), not a very good building stone. No. 5. They have practically the same composition, namely, sulphate of lime, but are known by different names; the transparent crystal is selenite associated with satin spar; the reddish amorphous piece is common gypsum (from which plaster of Paris is made) and the other sample is alabaster.—H. P. K.—The crystals in the sandstone are quartz.

COMMUNICATIONS RECEIVED.

On Rats. By W. M. P.
On Telephone. By G. H. S.
On Ice Yachts. By E. F. M.
Sailing Faster than the Wind Blows. By L. M.
On the Value of $\sqrt{-1}$. By I. B. N.
On a New Musical Instrument. By J. M. B.
On Employment of Farmers in Winter. By S. B.
On Ice Boat Propulsion. By J. L. V.

Union have greatly increased their yields. The Southern America.

may be rated by the proportion of silk which they contain.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

November 18, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air compressor, W. Gardner 221,802
Air injecting nozzle, D. C. Green 221,726
Alumina, making sulphate of, A. A. Croll 221,787
Animal trap, C. Koons (r) 8,975
Anvil and vise, combined, J. W. Cheney 221,781
Audiphone, W. W. Bostwick 221,800
Auger, hollow, C. H. Miller 221,692
Axle box, car, T. V. Le Roy 221,737
Bail ear and lifter attachment, C. F. Stites 221,876
Bark reducing machine, W. Shaw 221,970
Barrel pivot clutch, W. H. Hollenbeck 221,819
Bell striking mechanism, F. J. Herrick 221,730
Berth, sleeping car, M. Leiner 221,834
Bias stripe, preparing fabrics for cutting into, T. W. Bracher 221,718
Boiler and other furnaces, W. I. Klotz 221,682
Boiler furnace, W. A. Greene 221,808
Bones, retort and furnace for calcining, G. D. Davis 221,725
Boot and shoe heel finishing machine, A. J. Johnson 221,734
Boot and shoe lasting machine, G. W. Copeland *et al* 221,890
Boot and shoe sole channeling machine, F. D. Ballou 221,660
Boot and shoe uppers, machine for lasting, G. W. Copeland *et al* 221,668
Boot treeing machine, J. E. Crisp 221,786
Bottle stopper, C. B. Sponsler 221,874
Box nailing machines, nail feeding attachment for, H. Messer 221,844
Bracket, C. W. Stearns 221,875
Braid pin, C. C. Cook 221,721
Braid, etc., putting up, W. H. Stafford 221,748
Brewer's boiler, F. W. Schroeder 221,709
Broom holder, whisk, D. G. Mulford 221,739
Buckle, T. S. Richards 221,863
Bung, J. L. Johnston 221,827
Butter package, R. B. Griffin 221,810
Buttons, etc., manufacturing, W. F. Niles 221,832
Calendar and clamp, combined, J. W. Collins (r) .. 8,974
Camera screen attachment, L. Daft 221,670
Can and cover therefor, G. H. Chinnock 221,667
Car coupling, S. C. Doyle 221,797
Car coupling, T. H. Ellis 221,674
Car coupling, J. Whiteford 221,883
Car heater, railway, House & Bradbury 221,733
Car, railway, G. E. Sly 221,871
Car window, W. C. Hicks 221,678
Carbon sheets, cover for holding, J. S. McDonald. 221,839
Carboy, D. E. Seybel 221,706
Carbureting apparatus for railway cars, air, D. H. Jones 221,680
Carpet beating machine, M. Alley 221,782
Carpet stretcher, G. P. Cole 221,782
Carpet sweeper, H. S. Wing 221,700
Carriage boot, T. S. Smith 221,747
Casting puppets, core for, J. W. Post 221,741
Chain link, W. H. Dickey 221,795
Chains, making ornamental, E. F. Seery 221,745
Chimneys, locomotive and other, M. E. Walton ... 221,880
Chuck, lathe, J. N. Skinner 221,746
Churn, centrifugal, H. Bell 221,717
Cigar mould, N. Du Brul 221,671
Clevis, plow, I. L. Myers 221,851
Clothes pounder, T. H. B. Morehouse 221,849
Clothes pounder, W. N. Wylie 221,761
Clothes wringer, C. B. Camp 221,776
Cockle separators, cylinder for, J. Kasten 221,735
Concrete skip, E. Moore 221,847
Condenser, W. McIntyre 221,840
Copying, water well and brush for, J. Miller 221,845
Corset busk, J. B. Atwood 221,658
Cotton picking machine, F. F. Trenks 221,755
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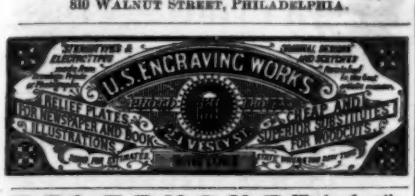

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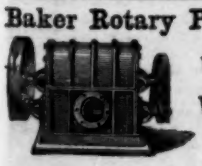

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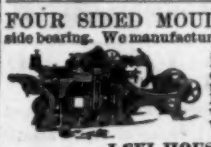

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